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Natividad Medical Center
Radiology Modernization

1441 Constitution Blvd
Salinas, CA 93906

PROJECT MANUAL

RBB# 1412600
OSHPD# S151318-27-00

April 28, 2017

OSHPD PLAN APPROVAL

REVIEWED IN ACCORDANCE WITH THE REQUIREMENTS OF T24, CCR
APPROVED
MAY 12 2017
Office of Statewide Health Planning & Development
FACILITIES DEVELOPMENT DIVISION

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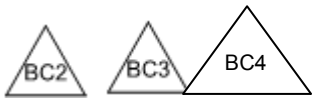


New Section	SECTION NNNNNN - SECTION TITLE
Removed Section	~~SECTION NNNNNN - SECTION TITLE~~
Section modified (see section)	**SECTION NNNNNN - SECTION TITLE**

TABLE OF CONTENTS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Natividad Medical Center Radiology Modernization, Project Number: 1412600.

1. Project Location: 1441 Constitution Blvd., Salinas, California.

B. Owner: Count of Monterey.

1. Owner's Representative: Brian Griffin, Interim Director of Engineering.

C. Architect: RBB Architects Inc., 10980 Wilshire Boulevard, Los Angeles, California 90024-3905.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Interiors: Gallun Snow Associates.
2. Strucutral: Rutherford + Chekene.
3. Mechanical, Electrical, Plumbing: ARUP.
4. Equipment: GBA Equipment Planning.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Renovation of the Radiology Suite at Natividad Medical Center.
2. Work not included in this Contract:

a. Work marked N.I.C. (Not In Contract) on Drawings.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in 5 phases, with each phase substantially complete as indicated per the Construction Drawings.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:30 a.m. to 3:30 p.m., Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

G. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
3. Abbreviations Used in Specifications:

a.	accord	accordance
b.	Co.	Company
c.	Corp.	Corporation
d.	cu.	cubic
e.	dia.	diameter
f.	Div.	Division
g.	ft.	foot (feet)
h.	gal.	gallon (gallons)
i.	hr.	hour
j.	in.	inch (inches)
k.	Inc.	Incorporated
l.	lbs.	pounds
m.	Mfg.	Manufacturing
n.	No.	number
o.	o.c.	on centers
p.	O.D.	outside diameter
q.	psi	pounds per square inch
r.	psf	pounds per square foot
s.	sq.	square
t.	T & G	Tongue and Groove
u.	U.S.	United States
v.	yd	yard (yards)

4. Symbols Used in Specifications:

a.	#1	number
b.	1#	pound
c.	&	and
d.	%percent	
e.	C	Centigrade
f.	F	Fahrenheit
g.	°	degree
h.	/	per, except where used to combine words; example: power/fuel.
i.	"	inch (inches)
j.	'	foot (feet)
k.	@	at

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
3. Any, none, or all of the alternate bids may be accepted or rejected in any sequence by Owner.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections and Drawings referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 2 (Deductive): Terminal Air Units.

1. Provide pre-assembled terminal air unit including reheat coil and piping accessoies, instead of field assembled counterparts as specified.

B. Alternate: No. 3 (Additive): Pre-Action System.

1. Provide pre-action system for MRI equipment and computer rooms as specified.

C. Alternate No. 4 (Deductive): Corridor Upgrades.

1. Minimal updgrades to Corridor IB093 and 1B086 as indicated on Drawings.

D. Alternate No. 5 (Deductive): Wood Ceiling.

1. Remove wood ceiling at reception desk as indicated on Drawings.

E. Alternate No. 6 (Deductive): Exterior Glazing.

1. At exterior glazing, salvage clear glass and spandrel glass for reuse to and/or where existing exterior vision panels are to be replaced with spandrel, laminate back of existing clear glass to match appearance of adjacent spandrel glass.

F. Alternate No. 7 (Deductive): Linoleum Flooring.

1. Provide pattern at corridor only, eliminate pattern at all rooms and install single field color from the specified palette to be selected by Designer.

G. Alternate No. 8 (Deductive):

1. IT data outlets and cabling reduced per Owner, TBD.

H. Alternate No. 9 (Deductive):

1. Electrical data outlets and cabling reduced per Owner, TBD.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
3. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use RBB Substitution Request Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that:

1) The proposed product or method substitution has been personally investigated by Contractor and determined that it is equal or superior in all respects to that specified.
2) The same Warranty will be provided for the substitution as for the product or method specified.
3) The installation of accepted substitution will be coordinated with the Work, including any changes required for Work to be complete in all respects.
4) All claims for additional costs related to substitution which become apparent will be waived.
5) All additional costs of construction performed by other separate contractors to accommodate accepted substitution will be assumed by the Contractor.
6) Architect's redesign costs will be borne by the Contractor.
7) The cost information is complete and includes all related costs, except Architect's redesign.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions during Bidding: Contractor's Base Bid shall be based on Contract Documents. Submit substitution requests for products on completed Substitution Request Form a minimum of 10 days prior to receipt of Bidsin accordance with Public Contract Code, Section 3400.

1. Conditions: Architect will consider requests from the Contractor for substitution of products in place of those specified.
2. If acceptable, requests submitted a minimum of 10 days prior to receipt of Bids will be included in an addendum.
3. Substitution requests submitted after 10 days prior to receipt of Bids will be considered only in the case of product unavailability or other factors beyond control of Contractor, such as:

a. Product has been discontinued.
b. Insufficient quantity is available.

1) Failure to award subcontract in sufficient time, or failure to place orders for products so as to insure delivery without delaying the work, does not establish cause for substitution.

c. Delays beyond Contractor's control, such as strikes, lockouts, storms, fires, or acts of God, which may preclude the procurement and delivery of products for purposes of the project.
d. A comparable product specified by naming lists of products or manufacturers is available.
e. Other reasons deemed justified by the Architect.

B. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions will not be considered if they are indicated or implied on Shop Drawings or Product Data submittals without formal substitution request submitted.

D. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

PART 4 - FORMS

4.1 PROJECT FORMS

A. Use forms immediately following this section:

1. Substitution Request Form.

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ or subcontractors of changes in the Work.

1.4 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

1.5 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Owner may issue a Bulletin which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications.

1. The bulletin may be issued as Request For Quote (RFQ) only. Contractor is to submit an itemized quotation for changes in the Contract Sum and/or Time, incidental to proposed modifications to the Contract Documents. Contractor is not to proceed with the work until so authorized.
2. The Bulletin may be issued as Architect's Supplemental Instructions (ASI) for minor changes to the work, not involving an adjustment to either the Contract Sum or Time. Contractor shall submit acceptance of the Bulletin for minor changes as consistent with the Contract Documents.

3. The Bulletin may be issued as Construction Change Directive (CCD) in order to expedite the work and avoid or minimize delays in the work which may affect the Contract Sum or Time. The Contract Documents are amended immediately, and Contractor is required to proceed with the modification promptly.

    a. CCD will be signed by the Owner.
    b. CCD will indicate the change in Contract Sum and Time (if any), and will indicate if these amounts are fixed, estimated, or maximum. The method used to compute these amounts will also be indicated.
    c. The Contractor is required to submit final cost and changes in time for the work involved (if any), as a Change Order Request (COR) for review and approval by the Architect.

B. Contractor-Initiated Proposals: The Contractor may propose a change by submitting a request for change to the Architect describing the proposed change and its full impact on the work. Contractor must identify request by a number obtained from the Architect which utilizes the Bulletin numbering system.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time, related work and work being performed under separate contracts.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. If accepted by the Owner, a CCD will be issued using methods outlined in Owner-Initiated Proposal Request paragraph of this Section.
8. Proposal Request Form: Use Contractor's Change Order Request Form (COR).

1.6 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.7 CHANGE ORDER PROCEDURES

A. On Owner's and Architect's approval of COR(s), Contractor will issue a Change Order for signatures of Owner, Architect, and Contractor on Owner's Change Order Form.

1.8 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on form included in Project Manual. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
2. Respond with documentation of changes in Contract Sum and Contract Time within 14 days of receipt of Bulletin issued by Architect. This time period shall not be extended without the express written consent of the Architect. No claims arising related to the Bulletin as issued by the Architect will be considered after the expiration of this time period.

1.9 CUMULATIVE COST AND TIME ADJUSTMENTS

A. Cumulative claims for cost and time will not be allowed. Assign all cost and time claims directly and proportionately to specific Bulletins and accompanied by a detailed scheduling analysis required by Division 01 Section "Construction Progress Documentation."

B. The Contractor may not reserve a right to assess impact cost, extended job site costs, extended overhead, and/or construction acceleration at some later date as related to any and all changes. Support costs or estimated costs with full schedule and cost documentation with each proposed change within the prescribed submission times. If a request for change is denied and the Contractor disputes the denial, the Contractor shall supply the aforementioned documentation to support the claim in accordance with Article 5.1 of the General Conditions for the Contract for Construction. The Contractor shall waive his right to impact, extended overhead costs and construction acceleration due to multiplicity of changes and clarifications.

1.10 RECONCILIATION OF CHANGE ORDERS

A. Schedule of Values: Promptly revise the Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjustment to the Contract Sum.

B. Schedules: Promptly revise progress schedules to reflect changes in Contract Time, revising sub-schedules to adjust time for other items of Work as may be affected by the Change. Submit revised schedules at next Application for Payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROJECT FORMS

A. Use forms immediately following this section:

1. RBB Bulletin.
2. Change Order Form.
3. OSHPD - Form OSH-FD-125.

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule and submittals schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with continuation sheets.
    b. Submittal schedule.
    c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in in excess of 5 percent of the Contract Sum.

    a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as a separate line item in the schedule of values.

10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement. Application submission date may be adjusted by mutual consent of the Owner and Contractor to coincide with regularly scheduled progress meetings or to accommodate holiday periods.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architectwill return incomplete applications without action.

    1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
    3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application. Do not include Change Orders until approved in writing by Owner and Architect.
    4. Include only amounts not in dispute.

5. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Preliminary Application Submittal: Five days prior to submittal of each Application for Payment submit a preliminary copy of the application indicating percentages of draws that will be requested, for review by the Architect, Owner's Representative, Inspector of Record (IOR), and Contractor. A portion of the Construction Meeting shall be allocated for this purpose. The Contractor shall incorporate any required revisions to the preliminary draft, and issue the Application for Payment with all of the required substantiating data for certification by the Architect.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit 5 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
2. Submit an updated Construction Schedule with each Application for Payment.

H. Lien Release: Provide conditional lien release with each Application for Payment, including conditional releases from all subcontractors, workers and materials suppliers employed for the Project. Unconditional lien release shall be provided for previous payments, as defined below.

1. Lien release shall cover portion of Work to date for which payment application is made.
2. Lien release shall total to the same dollar amount requested by the Application for Payment for any given month.
3. Lien release forms will be provided by Owner and shall be completed in accordance with directions provided.
4. Provide unconditional lien releases after payment is received for the prior month's Application for Payment, including unconditional releases from all subcontractors, workers, and material suppliers employed for the project during the prior month billed.

I. Substantiating Data: Submit substantiating information, as required by Owner and Architect, to substantiate dollar amounts on Application for Payment.

1. Substantiating information will normally be required only for those portions of Work whose completion state cannot be readily determined by observation of the completed Work, or for work and percentages the Architect or Contractor cannot agree to on the Preliminary Application for Payment.
2. Provide one copy of substantiating information with each copy of the Application for Payment.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."

6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination.
2. Coordination Detailing Activity (CDA).
3. Administrative and Supervisory Personnel.
4. Project meetings.
5. Requests for Interpretation (RFIs).

B. For projects using multiple contracts, each separate contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

B. CDA: The Coordination Detailing Activity is a coordination program to confirm aspects of the design in an orderly systematic way for renovation projects.

1.4 COORDINATION DRAWINGS

A. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in Revit 2015.
    c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Architect.

1.5 INFORMATION SUBMITTALS

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.7 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Drawings are diagrammatic, and are not intended to necessarily represent actual fit, tolerances, clearances, routing, or offsets required to achieve final coordination of systems for building components or to otherwise avoid conflicts between such components or systems.
2. Review Drawings, Specifications, and other Contract Documents to determine degree of difficulty required on Contractor's part to achieve proper coordination. Allocate sufficient funds, resources, and personnel, in addition to minimum personnel required by the Contract, to accomplish necessary coordination, fit, and routing of systems or components.
3. Conduct a Coordination Detailing Activity (CDA) Program for building systems listed in Coordination Detailing Activity Article below for all areas requiring renovation. CDA is not required in areas of all new construction.

4. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
5. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
6. Make adequate provisions to accommodate items scheduled for later installation.
7. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
8. Owner and Architect are not responsible for the quality or content of Contractor's work.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

E. Selective Demolition: Selective demolition for the purposes of accurately defining points of connection to existing infrastructure will be required if unknown conditions exist. This should be accomplished during preparation of coordination drawings and before completion of the final Coordination Detailing Activity (CDA) effort.

1.8 COORDINATION DETAILING ACTIVITY (CDA) FOR RENOVATION WORK

A. Purpose of the CDA and Work Included:

1. Purpose: The purpose of the CDA is to expeditiously produce fully coordinated shop drawings showing a composite of systems and subsystems, along with architectural and structural elements of the Work prior to fabrication of building systems. The CDA is intended to document trade coordination through development of shop drawing level detail, electronic file sharing, and coordination review meetings.
2. The Coordination Detailing Activity effort will be required on the building systems listed below in all areas requiring renovation. CDA is not required in areas of all new construction.

    a. Coordination for all items of work specified by Division 22 and 23.
    b. Coordination for all items of work specified by Division 26, 27 and 28.
    c. Coordination for all items of work specified in Divisions 22, 23, 26, 27, and 28 with work specified in all other Divisions of the Specifications.
    d. Utility coordination with architectural and structural work.
    e. Underground utility coordination with existing underground utilities.
    f. Medical equipment.

3. The Owner's Construction Manager, Contractor's project staff, a representative of the Architect, and its engineers are required to participate in this program. The basis of the Coordination Detailing Activity is to ensure that all utilities, and architectural and structural building systems are inter-coordinated and agreed upon by Contractor and its subcontractors before Work begins. At the completion of the Coordination Detailing Activity, Contractor and subcontractors are required to sign off their acceptance indicating that the work represented on the coordination drawings is constructible and has been reviewed by them, and that they are in concurrence with information contained on the coordination drawings. Engineering analysis is required for design of seismic bracing or overhead systems. CDA activity shall precede construction in all areas of Work listed in this Article when within the area of renovation.
4. The provisions of this Section do not lessen Contractor's responsibility for providing adequate coordination, including attendance at work site meetings as required by Owner for Work of the Contract including Work not indicated above.

B. Orientation Meeting:

1. Prior to the start of the CDA, meet with Owner and Architect to discuss the coordination effort. The purpose of this meeting is to develop a mutual understanding of the administration of the CDA, and the scope of the required submittals and coordination drawings. The orientation meeting shall be attended by all members of Contractor's project staff.

C. Coordination Meetings:

1. During the CDA, conduct coordination meetings with the Owner, Architect and its engineers, and subcontractors to discuss and coordinate the locations of utilities and building elements, problems of fit, trade interfaces, and constructability.

2. At a minimum, conduct coordination meetings at the 30 percent, 75 percent, and 100 percent completion points prior to the CDA finish milestone. The purpose of the 100 percent completion meeting is for Contractor and subcontractors to sign the fully coordinated drawings indicating their full approval, and for subcontractors, that each has fully coordinated its work with the work of Contractor and other subcontractors.
3. Conduct additional meetings as required to achieve full coordination, at no additional expense to Owner. Require subcontractors to attend CDA meetings as necessary.
4. Furnish 6 printed copies of the most up-to-date coordination drawings at all coordination meetings. Subcontractors shall bring reproducible original copies of the most up-to-date coordination drawings to all coordination meetings.
5. Owner and Architect will review and evaluate the routings and placements of the coordinated utilities, for compliance with the original design intent only.

D. Typical Coordination Detailing Activity (CDA) Sequence:

1. Compare Contract Drawings with field conditions: Review the Contract Documents and prepare the Coordination Drawings to agree with the actual conditions in the field.
2. Prepare Background Drawings: The mechanical subcontractor shall prepare background drawings that will become the common background drawings for detailing the work of all subcontractors. For convenience, the mechanical subcontractor may verify and update the Contract Drawings to use as a basis for the background drawings. The background drawings shall accurately reflect wall lines and other elements of the project such as beams, columns and existing utilities. In addition to the wall layout of the Work, the background drawings shall include anticipated locations of all light fixtures, diffusers and access panels. Finish ceiling elevations and above ceiling structural mounts for equipment shall be accurately dimensioned and noted on the background drawings.
3. Approve Background Drawings: Upon completion, the background drawings shall be reviewed by the Contractor and subcontractors. Contractor and subcontractors shall sign the background drawings indicating their approval and agreement to use the drawings as common backgrounds for all coordination. When approved, the background drawings shall be distributed to Contractor and subcontractors by Owner to be used as backgrounds for the preparation of the coordination drawings for each discipline.

    a. Detail duct and gravity flow lines: The mechanical and plumbing subcontractors shall detail the mechanical duct work (being the largest above-ceiling utility) and gravity flow plumbing lines as the first elements to be depicted and coordinated on the approved background drawings.
    b. Identify conflicts and proposed building systems: The mechanical and plumbing subcontractors shall identify conflicts associated with the proposed routing of the mechanical ductwork and the gravity flow plumbing lines, whether the conflicts are with new or existing underground utilities, structural members, or other elements within the space.

c. Resolve conflicts and re-detail as required: The mechanical subcontractor shall prepare a conflict list identifying conflicts and prepare plan view and cross sectional drawings that accurately represent the nature and location of the conflicts in plan and elevation. Contractor and subcontractors shall work with Owner and Architect to identify alternate acceptable routes for new Work in conflict. The mechanical subcontractor shall re-detail coordination drawings as required to avoid building systems that cannot be relocated.

d. Prepare overlay drawings for coordination of new electrical and remaining mechanical systems on background drawings: Upon the completion of the HVAC and gravity flow coordination effort, the building systems provided by the electrical, control systems, plumbing and fire sprinkler subcontractors shall be integrated with the HVAC and gravity flow lines by each respective subcontractor. Contractors and subcontractors shall prepare an overlay coordination drawing for each system, such as electrical, plumbing, chilled water, and fire sprinklers. The approved background drawings with mechanical ductwork and gravity flow plumbing system will serve as the background drawings for these systems.

e. Identify conflicts with proposed systems: Contractor and subcontractors shall compare and identify conflicts between their proposed systems and other systems proposed or existing, and revise their coordination drawings with the intent of eliminating or reducing the interferences and conflicts. Contractor shall work closely with Owner, subcontractors, and Architect to integrate and coordinate all new systems with the design intent of the Contract Documents.

f. Resolve conflicts and re-detail as required: Upon the completion of this coordination effort, Contractor and subcontractors shall develop a conflict list to identify systems that, after previous coordination efforts, are still in conflict with another building system. Contractor and subcontractors shall also prepare plan view and cross sectional drawings as required to accurately identify each conflict and its exact location. Subcontractors shall re-detail coordination drawings as required to avoid building systems that cannot be relocated.

g. Signing of coordination drawings indicating full coordination and fit of all new building systems: The end product of this effort will be a fully coordinated set of drawings, consistent with the design intent and applicable building codes for the new Work. Contractor and subcontractors shall indicate that they have coordinated their work by signing the coordination drawings. Upon the execution by Contractor and subcontractors of the coordination drawings, shop drawings and fabrication may proceed.

4. All conflicts shall be resolved through the CDA process rather than at the installation stage. Conflicts occurring at the installation stage will not be the basis of claim for additional costs or time extensions. Change Order Requests at this stage will not be the basis for additional costs or time extensions, and Requests for Interpretation (RFI's) will not be accepted by the Owner during the CDA process for any issue being currently coordinated. Issues shall be resolved by the CDA process and documented on the coordination drawings. Cost and schedule impacts shall be made known according to the requirements of this Section.

5. Coordination services shall include review of all construction documents for their completeness, constructability and code compliance. Failure to perform these services satisfactorily will not be the basis for additional compensation after signing the coordination drawings. Coordination of trade subcontractors work is the responsibility of the Contractor. Coordination of CDA activity is the responsibility of the Contractor. Constructability review is the responsibility of the Contractor. The Contractor is obligated to search for these issues as part of the CDA process. Remaining applicable code deficiencies or omissions remain the responsibility of the Architect and engineers of record.

E. Change Order Requests During CDA:

1. Change Order Requests regarding issues being detailed and coordinated under the provisions of this Section will not be accepted by Owner during the CDA.
2. If Contractor claims an entitlement to an adjustment in the Contract Sum or Contract Time as a result of revisions made according to this Section, its request for such adjustment shall be submitted according to Contract Modification Procedures outlined in Division 01 Section "Contract Modification Procedures." These procedures shall be followed after the conclusion of the CDA process should a scope change arise, and will be processed in accordance with the Contract Modification Procedures section.

F. Coordination Drawing Preparation:

1. Contract Drawings may be obtained in electronic file format for use in the preparation of coordination drawings.
2. Coordination drawings shall be produced at a scale of 1/4 inch = 1 foot.
3. Coordination drawings shall contain a title block in the lower right hand corner of the drawing sheet indicating specific location and extent of Work covered, and subcontractor's company name.
4. Dimension the location of utilities, and architectural and structural building components, vertically and horizontally, to within 1/4 inch. Indicate the size of ducts, pipes, and other components.
5. A release agreement with the Architect must be executed by the trade subcontractor prior to use of electronic files.

G. Coordination Schedule: Indicate a detailed breakdown of the entire CDA process on the Preliminary Construction Schedule and Contractor's Construction Schedule. This breakdown shall at minimum show CDA activities for each area of renovation.

1.9 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Owner will administer preconstruction conference for execution of Owner Contractor Agreement and exchange of preliminary submittal and other data.

1. Schedule: Schedule Preconstruction Conference within 10 days of Notice to Proceed.
2. Location: Preconstruction conference will be held at office of Owner, unless otherwise directed.

C. Site Mobilization Conference: Schedule a site mobilization conference before starting construction, at a time convenient to Owner and Architect, but no later than 7 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designate key personnel and update project directory for Owner, Architect, Architect's consultants, Owner's consultants, Contractor, major subcontractors, major materials suppliers, serving utility agencies and companies, other subcontractors performing work under separate contractor, and governing authorities having jurisdiction.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of Record Documents.
    l. Use of the premises and existing building.
    m. Work restrictions.
    n. Owner's occupancy requirements.
    o. Responsibility for temporary facilities and controls.
    p. Construction waste management and recycling.
    q. Parking availability.
    r. Office, work, and storage areas.
    s. Equipment deliveries and priorities.
    t. First aid.
    u. Security.
    v. Progress cleaning.
    w. Working hours.

x. Subcontractors List: Distribute and discuss list of subcontractors and suppliers.
y. Permits and Fees: Review Contract requirements; review tentative construction schedule and process for obtaining permits and paying fees.

3. Minutes: Architect will record and distribute meeting minutes.

D. Preinstallation Conferences: Conduct a Preinstallation Conference at Project site before each construction activity that requires coordination with other construction. When required in individual specification Sections, convene a Preinstallation Conference prior to commencing Work specified in the Section.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Progress Meetings: Periodically schedule Project meetings throughout progress of the Work. Determine frequency of Project Meetings as necessary for progress of Work. Generally, it is intended that progress meetings be held at biweekly intervals; except hold weekly meetings for the final month during Contract Closeout.

1. Administration: Make physical arrangements for meetings. Submit proposed agenda to participants. Architect will preside at meetings, record minutes and distribute copies within five days to Owner, Contractor, participants and those affected by decisions made at meetings.
2. Attendees: Contractor's project manager and jobsite superintendent shall attend each meeting. Contractor's subcontractors and suppliers may attend as appropriate to subject under discussion. Owner's representative will attend each meeting. Architect, Architect's consultants, and Inspector of record (IOR), will also attend as appropriate to agenda topics for each meeting and as provided in Owner-Architect Agreement.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Long-lead time equipment and material delivery schedule.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) RFIs.
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

4. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    k. Owner's partial occupancy requirements.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

1.10 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents prepare and submit an RFI in the attached form "Request For Interpretation." Failure to submit questions on this form or failure to complete "Contractors Recommended Solution" will be cause for rejection of the request for interpretation by the Architect. The Contractor must indicate if there will be a cost or time impact for the complete "Contractors Recommended Solution" at the time of submission. Contractor is not obligated to identify the extent of cost or time impact at the time of submission.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

3. Provide digital photographs attached within the RFI to the Architect when applicable to describe field conditions or when required by the Architect.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Digital RFIs: MS Word Template with Form Fields for all the information above.

D. The Architect will maintain an RFI log to track information pertaining to the RFI and its response. See attached sample at the end of this Section. This Log will be available to all members of the construction team on a monthly basis as a minimum.

1. All RFIs will be graded by the Architect at the time a response is generated and the RFI is returned to the Contractor. RFIs will be graded as follows:

    a. Grade 1 - A Request For Interpretation that is not required to be answered by the Architect where issues are defined to be under the control and coordination of the Contractor by the Contract Documents. Contractor is prohibited from claims for delay or cost involving adjustment to the Contract Time or the Contract Sum for any RFI responses that are in this category.
    b. Grade 2 - A Request For Interpretation where the Architect directs the Contractor to an existing response or answer within the Contract Documents; issues where the Contractor has not exhausted its capabilities to find the information within the Contract Documents, including referenced standards incorporated and made part of the Contract Documents. Contractor is prohibited from claims for delay or cost for any RFI responses that are in this category.

c. Grade 3 - A Request For Interpretation that the Architect is required to respond to with a clarification or modification to the Contract Documents, which results in no adjustment to the Contract Sum or the Contract Time. An Architectural Supplemental Instruction will be issued in which the Contractor shall confirm that there is no cost or time impact. Contractor is prohibited from claims for delay or cost involving adjustment to the Contract Time or the Contract Sum involving adjustment to the Contract Time or the Contract Sum for any RFI responses that are in this category.
d. Grade 4 - A Request For Interpretation that the Architect is required to respond to with a clarification or modification to the Contract Documents, which results in an adjustment to the Contract Sum or the Contract Time. Contractor will be requested to address claims for delay or cost if any, by responding to a Bulletin that the Architect will issue as a result of RFI's in this category. A Construction Change Directive or Change Order will be required to proceed with the Work.

2. Review and response to all RFIs of Grade 3 and Grade 4 will be included in the Architect's and Consultant's scope of service. Review and response to Grade 1 and Grade 2 RFIs that exceed 10 precent of the entire RFI quantity at the completion of the project will be considered additional scope services to be paid by the Contractor through the Owner. The Architect shall be paid hourly at 2.5 times direct payroll expenses. Consultants time shall be paid at 1.25 times the amount billed the Architect. A unit cost of 1 hour per discipline involved per RFI will be used as the basis for these charges.
3. The Quantity of RFIs are not considered a reason in and of itself for claims for time or money (cumulative or direct) on the part of the Contractor. All Claims involving adjustment to the Contract Time or the Contract Sum must be associated with respective Bulletins and documented with a scheduling analysis as outlined in Division 01 Section "Construction Progress Documentation."
4. Architect's action: Responses and distribution will be within 7 working days from the date the RFI is received from the Contractor. Failure to respond to RFIs within this time frame will not be considered grounds for Contractor's claim for time impact, unless substantial evidence is provided as outlined in Division 01 Section "Construction Progress Documentation."
5. Provide adequate time for the Architect to process all RFIs to prevent delay in construction schedule. Failure of the Contractor to perform coordination efforts required to generate RFIs in a timely fashion, so as not to adversely impact the schedule, will be considered forfeiture of the right to delay claims for up to the 7 working days allowed for processing and distribution of the Architect's response.
6. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or RFIs with numerous errors.

7. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
8. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - FORMS

4.1 PROJECT FORMS

A. Use forms immediately following this section:

1. RFI Request Form.
2. RFI Log.

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting the Schedule of Values.
2. Section 013100 "Project Management and Coordination" for submitting and distributing meeting and conference minutes, and reviewing at progress meetings.
3. Section 013233 "Photographic Documentation" for submitting construction photographs.
4. Section 013300 "Submittal Procedures" for submitting schedules and reports.
5. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting for Certificate of Occupancy, final inspection for acceptance, and final Application for Payment.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup construction schedule.

1. Designate in construction schedule dates for submission and dates reviewed Shop Drawings, Product Data, and Samples will be needed for each product.
2. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Material Location Reports: Submit at weekly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications:

1. Staff: 2 or more employees regularly engaged and skilled in the application of CPM to similar size construction projects.
2. Resources: Possess or have access to a library of computer programs for production of schedules and cost reports.
3. Facilities: Have computer facilities or access on short notice to computer facilities.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Introduction of scheduling personnel.
2. Review software limitations and content and format for reports.
3. Discuss constraints, including phasing work stages and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

C. Scheduling System Requirements:

1. Submit a written list of the minimum hardware and software requirements at the Pre-Construction Scheduling Conference.
2. Locate equipment required for the scheduling of the Work at the site.

3. Submit Samples of the specified output for review and orientation of the Owner and the Architect.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Environmental control.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:

1. Temporary enclosure and space conditioning.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Develop a network plan and schedule for the project demonstrating complete fulfillment of all contract requirements. Keep the network plans up to date in accordance with the requirements of this Section, and utilize the CPM to plan, coordinate, perform, and report the Work under this Contract. Include all activities of Subcontractors, equipment vendors, and suppliers, and assist the Owner and Architect to monitor the progress of the Work.

1. Use either the activity-on-arrow (ADM) or precedence (PDM) diagramming method to prepare the CPM Schedule network diagrams.

B. Startup Network Diagram: Submit diagram within 15 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include with the submittal the general method for performing the work required for the remainder of the project.

1. In conjunction with major subcontractors, propose project activities, sequences, and durations for the Startup Network Diagram translated into a separate network diagram following the CPM format as described in this Section.
2. Participate in a review of each proposed Startup Schedule by Owner and Architect when requested to do so.
3. Resubmit for review, within 10 days after the Preconstruction Scheduling Conference required by this Section, any revisions deemed necessary by the Owner and Architect as a result of this joint review.
4. After acceptance of the schedule, provide a reproducible copy and five prints of the Preliminary Schedule to the Architect. Acceptance of the Startup Schedule will be a condition precedent to the making of any progress payments.
5. No construction work will be permitted and no progress payments will be made until acceptance of the preliminary Project Schedule.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Within 30 days after receipt of Notice to Proceed, submit the complete Project Schedules for the remaining portion of the procurement and construction activities. Clearly indicate that the time for completion will be met. Any contingency (difference in time between the project's early completion and the required completion date) in this schedule belongs to the project, not to any one party to the Contract. Submit a network diagram together with a computer produced printout as part of the Project Schedule. The initial submittal may show starting and completion dates for each activity in terms of the number of days after receipt of Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
5. Participate in a review of the proposed Project Schedule Preparation" Paragraphby the Architect and Owner when requested to do so.

    a. Re-submit any revisions deemed necessary as a result of this joint review within 20 days after the Pre-Construction Scheduling Conference required by this Section.

6. The accepted Project Schedule constitutes the schedule to be used by the Contractor for executing the work under the Contract, including but not limited to planning, organizing, and directing the work and reporting progress until subsequently revised.
7. Furnish one reproducible copy and three prints of the Project Schedule to the Architect, and one reproducible copy to the Owner.
8. Acceptance of the Project Schedule and subsequent updates will be a condition precedent to the making of any progress payments for work performed beyond 60 days from receipt of the Notice to Proceed.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.

e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and commissioning.
j. Punch list and final completion.
k. Work required to be completed before an activity can be started.
l. Work which can be done concurrently.
m. Work required to be started immediately following completion of an activity.
n. Major construction methodology, procedure or manpower restriction associated with the sequence.

2. In preparing the arrow or precedence diagram, break up the work into construction activities so that the duration of each activity will not exceed 15 working days. Non-construction activities (such as procurement of materials, delivery of equipment, and concrete curing) may have activity durations in excess of 15 working days.

   a. Clearly indicate the appropriate Specification Section or trade, and all salient features and number of activities shall be subject to the Architect and Owner's acceptance in the selected activity. Show not only the activities for actual construction work for each trade category of the Project, but also such activities as the preparation and submittal of shop drawings and OSHPD Deferred Approval items, product data and samples, the Architect's / Agency review of such submittals, fabrication and delivery of material and equipment.
   b. Furnish the activity duration (i.e., the single best estimate of time required to complete the activity considering the scope of the activity) for each activity on the diagram.
   c. Failure by the Contractor to include any element of the work required for the performance of this Contract does not excuse the Contractor from completing all work required within the time for completion, not withstanding the Architect's and Owner's acceptance of the Project Schedule.
   d. Schedule submittal submissions in accordance with Division 01 Section "Submittal Proceedures." Incorporate the same review time as the initial submittal in all re-submittals. Schedule 90 days for OSHPD review of structural Deferred Approval item, and 60 days for OSHPD review of non-structural Deferred Approval item. OSHPD resubmittals required shall incorporate the same review time as the original submittal.
   e. Show deliveries of Owner-Furnished equipment or materials on the schedule identifying the earliest possible delivery date "not earlier than" as well as the "not later than" date, as defined by the Owner and manufacturer.

3. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
4. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
5. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

6. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

   a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
   b. Total cost assigned to activities shall equal the total Contract Sum.

7. Include a line item for "Project Schedule" in the Schedule of Values on the Application for Payment.

   a. The Contractor is entitled to bill against the "Project Schedule" line item only when the baseline schedule and each monthly update have been accepted by the Architect.

8. In addition to the above network requirements, furnish cost estimates for each activity which cumulatively equal the total contract cost. Mobilization costs may be shown separately, however other costs, such as for profit and bonds, shall be prorated throughout all activities.
9. Provide the following in the network arrow or precedence diagram with respect to each activity:

   a. I-J Node numbers or activity numbers.
   b. Activity description.
   c. Activity duration estimate.
   d. Specification Section, where applicable.
   e. Performing organization.
   f. Activity cost/Schedule of Values (scheduled and actual to date).

10. Present, on the accompanying computer printout, the following schedule information for each activity:

    a. Early Start and Early Finish Dates.
    b. Late Start and Late Finish Dates.
    c. Activity Float.
    d. Actual Start and Actual Finish Dates.

11. Sort the computer printout as follows:

    a. A listing of all activities by number sequence.
    b. A total float/variance listing of all activities.
    c. An activity sort by Specification Section or trade.
    d. An activity sort by performing organization.
    e. An activity cost/Schedule of Values report which shall indicate the total dollar value scheduled to be in place each month.

f. A procurement schedule identifying order and delivery dates of major pieces of equipment listed in the equipment schedules.

12. Subcontractor's Participation:

a. Solicit major subcontractor participation in the preparation of the Project Schedule and any subsequent updates.
b. Require major subcontractors to sign off on the baseline schedule and all schedule updates.
c. Major subcontractors include:
d. Structural Steel (if required by Division 05).
e. Structural Concrete and Pneumatically Placed Concrete (if required by Division 03).
f. Finish Carpentry and Millwork.
g. Gypsum Board and Light Gauge Framing Systems.
h. Elevators (if required by Division 14).
i. Mechanical: Plumbing.
j. Mechanical: HVAC.
k. Electrical.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.
8. In addition to items listed above provide:

a. A narrative report with each updated Project Schedule: Include in the narrative report a description of all activities completed during the preceding month, and a description of progress made and planned for activities listed as started but not completed on the updated Project Schedule. In the event there are any current or anticipated conditions which have or may have the effect of delaying the work, the estimated impact of such conditions upon the performance of affected activities and upon the times for completion shall be described, and recommendations for corrective action made.
b. A monthly updating of the Project Schedule: This updating shall be an integral part and basic element of the estimate upon which progress payments will be made. Submittal, review and acceptance by the Architect, of the updated Project Schedule shall be a condition precedent to the making of progress payments. If, in the judgment of the Architect, the Contractor fails or refuses to provide a complete Project Schedule update or/ revision, as specified, the Contractor will be deemed to have not provided the required estimate upon which progress payments may be made, and shall not be entitled to such progress payments unless or until it has furnished the aforesaid schedules.

H. Adjustments of Times for Completion:

1. In addition to provisions of General Conditions, the time for completion of the work will be adjusted in accordance with these procedures.
2. Any request for an adjustment of the contract time for completion submitted by the Contractor for changes, or alleged delays, shall be accompanied by a complete Time Impact Analysis submitted for review within 20 days after the request by Contractor. Time extensions will not be granted unless substantiated by the CPM Schedule, and then not until the CPM project float contingency becomes zero.
3. Each Time Impact Analysis shall provide information justifying the request and stating the extent of the adjustment requested for each specific change or alleged delay. Each time Impact Analysis shall be in form and content acceptable to the Architect and shall include, but not be limited to, the following:

    a. A fragmentary CPM type network (Fragnet) illustrating how the Contractor proposed to incorporate the change or/alleged delay into the current updated Project Schedule.
    b. Identification of activities in the current updated Project Schedule which are proposed to be amended due to the change or alleged delay, together with engineering estimates and other appropriate documentation justifying the proposal.

4. The Time Impact Analysis shall be determined on the basis of the date or dates when the change or changes were issued, or the date or dates when the alleged delay or delays began. The status of the construction project and Time Impact Analysis shall include event time computations for all affected activities.
5. The Architect may require that Time Impact Analyses be provided in order to demonstrate the time impact upon the overall project and the time for completion, at no additional cost to Owner.

6. If the Architect finds after review of the Time Impact Analysis that the Contractor is entitled to any extension of time for completion, the time for completion will be adjusted accordingly by the Architect, and the Contractor shall then revise the Project Schedule accordingly.
7. The CPM schedule will be used to analyze the claim for each day of alleged delay after the contract completion date, as adjusted, until the work is accepted.

I. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

J. Ownership of Float

1. Pursuant to the contract's float sharing requirements, no time extensions will be granted nor delay damages paid until a delay occurs that impacts the critical path, consumes all available float or contingency time available, and extends the work beyond the contract completion date.
2. Float created by either the Owner, or Architect, or the Contractor shall be credited to that party on a monthly basis which can then be credited against any subsequent delays until such time as the banked float is exhausted.
3. Pursuant to the float sharing requirements of the Contract Documents, the use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity time are prohibited, and the use of float time disclosed or implied by the use of alternate float suppression techniques shall be shared to the proportionate benefit of the Owner and the Contractor. Any sequestering of float shall be cause for rejection of the schedule submittal.

K. As-Built CPM Submittal:

1. Submit an "As-Built" schedule as a condition precedent to retainage release.
2. The As-Built Schedule shall be certified by the Contractor's project manager and project scheduler as representing the way the project was actually constructed.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.

2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. List of visitors to site, giving name, company or agency affiliation, and telephone number.
6. Material deliveries.
7. High and low temperatures and general weather conditions, including presence of rain or snow.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events (see special reports).
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, or at lesser intervals if deemed necessary by the Architect, and without additional cost to Owner for reasons such as progress of Work 14 days or more behind schedule, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Meet with the Architect and Owner each month to review actual progress made to date, activities started and completed to date, and the percentage of work completed to date on each activity started but not completed. Upon completion of the joint review, prepare the updated Project Schedule and submit it to the Architect and Owner for review.
2. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
3. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
4. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
4. Section 024119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 ALLOWANCES

A. Costs: Photographic documentation services are included under the cash allowance for construction photographic services established in Section 012100 "Allowances."

1.4 UNIT PRICES

A. Basis for Bids: Base number of construction photographs on average of 4 photographs per week over the duration of Project.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

    a. Name of Project.
    b. Name and contact information for photographer.
    c. Name of Architect.
    d. Name of Contractor.
    e. Date photograph was taken.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    g. Unique sequential identifier keyed to accompanying key plan.

D. Construction Photographs: Submit three prints and set of digital image electronic files of each photographic view within five days of taking photographs.

1. Format: 4• by 6• color prints on 8 1/2 x 11 high resolution 20 lb. ink jet paper punched for standard three-ring binder.
2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

    a. Name of Project.
    b. Name and contact information for photographer.
    c. Name of Architect.
    d. Name of Contractor.
    e. Date photograph was taken if not date stamped by camera.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    g. Unique sequential identifier keyed to accompanying key plan.
    h. Label each print on the front in the bottom margin with project name and date the photograph was taken.

1.6 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years. Photographer should be knowledgeable in digital photography, file transfer protocol and construction work. Photographer may be an individual on Contractor's staff.

1.7 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.8 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified commercial photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

D. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and as necessary to show all existing conditions.

E. Periodic Construction Photographs: Take 10 photographs bi-weekly with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

1. Take photographs as necessary to describe Change Order Requests and Requests for Information (RFIs). Digital photographs shall accompany RFI's when required to clearly describe the field condition.

F. Architect -Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp.

H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum or in the allowance for construction photographs.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals required by the Specification Sections to the Architect and Construction Manager.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include dates for submission and time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's and Construction Manager's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in Revit 2015.
    c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.

d. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.
2) Reflected ceiling plans.

B. Submittal Log Number: Assign a unique submittal number to each submittal.

1. Use Project Manual Specifications list as the basis for number identification of all submittals.
2. Affix the specification number under which each submittal is made on every copy of each shop drawing, product data, sample, certification, operation and maintenance data, etc. For example, Overhead Coiling Doors shop drawings would bear the number 083323.
3. On the first type or group of submittals under each specification number, add the suffix designation 1A. For example, Overhead Coiling Doors shop drawings with its product data would be numbered 083323-1A. The number suffix indicates it is the first type or kind of submittal under that specification section; the letter suffix indicates whether it is the original submittal or a resubmittal.
4. Include all information requested by each specification in the original submittal. No partial submittals will be accepted unless previously authorized by the Architect and Construction Manager. In the event a partial submittal is authorized, number each subsequent different submittal (as opposed to resubmittal) sequentially. For example, if operation and maintenance data are submitted at a later date, they should use the number 2 in the suffix, as in 083323-2A.
5. If a submittal is rejected, returned not reviewed, or marked "Revise and Resubmit," indicate the subsequent resubmittal by the letter suffix designation. For example, if the original Overhead Coiling Doors shop drawings were marked "Revise and Resubmit", the first resubmittal would be numbered 083323-1B.
6. See example page of RBB Shop Drawing Log at the end of this Section.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently. Partial submittals for portions of the Work will not be allowed. Incomplete submittals will be returned not reviewed.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. Schedule submissions at least 30 days before dates reviewed submittals will be needed.

1. Initial Review: Allow 20 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect Construction Manager, through Architect, before being returned to Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with Project identifier and submittal number, including revision identifier for resubmittals.
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use acceptable to Owner, containing the following information:

    a. Project name and Architect's Project number.
    b. Date, and revision date for resubmittals.
    c. Submittal log number.
    d. Name and address and address of Architect.
    e. Name and address of Contractor.
    f. Name and address of firm or entity that prepared submittal.
    g. Names and address of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Quantity of each shop drawing, product data set, and sample submitted.
    p. Identification of deviations from Contract Documents.
    q. Submittal and transmittal distribution record.

r. Other necessary identification.
s. Remarks.
t. Digital signature of transmitter.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with Architect's and Construction Manager's action stamp and initials or signature indicating review as "Action Code 1" Reviewed; No Exceptions Taken• or "Action Code 3" Furnish as Corrected; Resubmittal Not Required.•
4. Number of resubmissions: One reexamination of Contractor's submittals, which have been returned for correction or replacement, will be included in the Architect/Consultant's scope.

a. Any additional reexamination of Contractor's submittals will be considered additional scope services to be paid by the Contractor through the Owner. The Architect shall be paid hourly at 2.5 times direct payroll expenses. Consultant's time shall be paid at 1.25 times the amount billed to the Architect by the Consultant.
b. Include request for Architect/Consultant's additional scope services with third and subsequent submittals.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, other prime contractors, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

1. Distribute copies of Shop Drawings and Product Data which carry Architect's stamp, to Contractor's file, Project Site file, Project Record Documents file, subcontractors, supplier, fabricator, and other prime contractors.
2. Distribute Samples as directed.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals with action stamp and initials or signature indicating "Action Code 1 "Reviewed; No Exceptions Taken" or "Action Code 3 "Furnish as Corrected; Resubmittal Not Required" action taken by Architect and Construction Manager. Do not begin Work which requires submittals until return of submittals with one of these action stamp notations.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a dated statement that includes identification of Project and signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Clearly identify the referenced materials and state that the materials and the intended installation methods, where applicable, are in compliance with the Contract Documents for this Project.
    b. Attach manufacturer's affidavits, signed by an officer or other individual authorized to sign documents on behalf of entity responsible for preparing the certification, where applicable.
    c. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    d. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's written recommendations.
    c. Manufacturer's product specifications.

d. Manufacturer's installation instructions. Include dimensions and clearances required for proper installation.
e. Standard color charts.
f. Mill reports.
g. Standard product operation and maintenance manuals.
h. Statement of compliance with specified referenced standards.
i. Testing by recognized testing agency.
j. Application of testing agency labels and seals.
k. Notation of coordination requirements.
l. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring and controls.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare and submit Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Dimensions.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
f. Details identified by reference to sheet and detail numbers shown on Contract Drawings.
g. Shop manufacturing instructions.
h. Templates and patterns.
i. Schedules.
j. Design calculations.
k. Compliance with specified reference standards.
l. Notation of coordination requirements.
m. Notation of dimensions established by field measurement.
n. Relationship and attachment to adjoining construction clearly indicated.
o. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

4. BIM File Incorporation: Construction Manager will incorporate Contractor's Shop Drawing files into Building Information Model established for Project.

    a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
    b. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

7. Submit new samples if required as specified for initial submittals.

E. Field Samples and Mock-Ups:

1. Erect at Project site at location acceptable to Architect and Construction Manager.
2. Construct each field sample or mock-up as a complete assembly. Include work of trades required in finished work.

F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.

G. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

H. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

I. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

J. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

K. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

L. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

M. OSHA Submittals: Comply with requirements of OSHA Hazard Communication Standard 29 CFR 1910.1200.

1. Submit information directly to Owner; do not submit to Architect, except as required for OSHA Submittals for LEED certifications.
2. Architect will not review non-OSHA submittals that include MSDSs and will return the entire submittal for resubmittal.

N. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

O. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

P. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

Q. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

R. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

S. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

T. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

U. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

V. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

W. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

X. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

Y. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Z. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

AA. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

BB. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

CC. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

DD. Construction Photographs: Comply with requirements specified in Section 013233 " Photographic Documentation.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for completeness and coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

1. Return submittals not in compliance with Contract Documents to subcontractors for resubmittal.
2. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittal.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Architect's Duties:
1. Review submittals with reasonable promptness.
2. Review submittals for compliance with design concept of Project and information given in Contract Documents.
3. Stamp and initial or sign action submittals certifying review of submittal.
4. Return action submittals to Contractor for distribution.
5. Distribute informational submittals to appropriate parties.

B. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

C. Architect will perform an initial triage and return without action submittals that do not meet the following minimum criteria.
1. Submittal is complete.
2. No substitution requests are included.
3. Deviations from Contract Documents are identified.
4. On resubmittals, revisions not requested by Architect are identified.

D. If submittal is a third or subsequent submittal, request for Architect/Consultant's additional scope services is included.

E. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. Action Code 1 " Reviewed; No Exceptions Taken: No further review of submittal is required.
2. Action Code 2 " Incomplete Submittal; Submittal is Not Reviewed: Contractor™s review and signature is required indicating their review and approval; and/or submittal is incomplete for reasons noted. Resubmit.
3. Action Code 3 " Furnish as Corrected; Incorporate Revisions in Work: Resubmittal not required. If Contractor cannot comply with corrections noted, revise and resubmit.
4. Action Code 4 - Revise and Resubmit: Revise as noted and resubmit for further review.
5. Action Code 5 - Not Reviewed; Submittal is Not Required by the Contract Documents: No action taken.

F. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

G. Partial submittals prepared for a portion of the Work will only be reviewed when use of partial submittals has received prior approval from Architect.

H. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

I. Submittals not required by the Contract Documents will not be reviewed and will be returned by the Architect without action.

PART 4 - FORMS

4.1 PROJECT FORMS

A. Use forms immediately following this section:

1. Submittal Log.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control including but not limited to the following:

1. Quality of the Work.
2. Contractor's quality control.
3. Quality Control (QC) program requirements.
4. Regulatory requirements for testing and inspection.
5. Inspections and tests by governing authorities.
6. Inspections and tests by manufacturer's representatives.
7. Inspections by Independent Testing and Inspection Agency.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Section 013100 "Project Management and Coordination" for coordination of Work of the Contract.
2. Section 013200 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
3. Section 013300 "Submittal Procedures" for procedures for submitting action, informational, and delegated-design submittals.

4. Section 014100 "Regulatory Requirements" for compliance with applicable codes, ordinances, and standards.
5. Section 016000 "Product Requirements" for product options, substitutions, transportation and handling requirements, storage and protection requirements, and system completeness requirements.
6. Section 017300 "Execution" for repair and restoration of construction disturbed by testing and inspecting activities.
7. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP) accredited testing agency, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 013300 "Submittal Procedures."

B. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Test and Inspection Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.

13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Quality Control (QC) Submittals:

1. Quality Control (QC) Plan: Submit a QC plan, as defined in QC Plan Article in this Section, within 30 calendar days after receipt of Notice of Award.
2. Quality Control (QC) Documentation: Submit the following to the Owner's Representative:

a. Combined Contractor Daily Report and Contractor Quality Control Report: Original and 1 copy by 10:00 AM the next working day after each day that work is performed.
b. QC Specialist Reports and Test Results: Original and 1 copy by 10:00 AM the next working day after each day that work is performed.
c. Testing Plan and Log: 1 copy, at the end of each month.
d. QC Meeting Minutes: 1 copy within 2 calendar days of the meeting.
e. Rework Items List: 1 copy, by the last working day of the month.
f. QC Certifications: As required in Quality Control (QC) Certifications Article of this Section.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Quality Control Manager Qualifications: An individual with a minimum of 10 years experience as a superintendent, inspector, QC Manager, project manager, or construction manager for similar size construction contracts which included the major trades that are part of this Contract.

G. Alternate Quality Control Manager Qualifications: Same as Quality Control Manager.

H. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

I. Submittal Assistant Qualifications: An individual with a minimum of five years experience as a project engineer, scheduler, or construction related worker.

J. Testing Agency Qualifications: An AASHTO, A2LA, NIST, NRTL, NVLAP, or independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities. Furnish to the Owner's Representative, a copy of the Certificate of Accreditation, Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1. AASHTO: American Association of State Highway and Transportation Officials.
2. A2LA: American Association for Laboratory Accreditation.
3. NIST: National Institute of Standards and Technology.
4. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
5. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

K. Prior to approval of a laboratory, the proposed testing laboratory facilities and their records shall be subject to inspection by the Owner's Representative, Architect and Inspector of Record (IOR). Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and internal QC procedures.

L. Capability Check: The Owner's Representative retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

M. Test Results: Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable.

1. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports.
2. Furnish the signed reports, certifications, and other documentation to the IOR via the QC Manager.
3. Furnish a summary report of field tests and an exception report listing all items which do not conform and have not been corrected at the end of each month.
4. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

N. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

O. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor Responsibilities:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

P. Mockups, General: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated and work of trades required for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

Q. Mockup Rooms:

~~?. Provide completed mockup rooms of the following types, completely finished, including adjacent toilet room.~~

~~?. Med Surge patient room.~~
~~?. Patient Holding headwall.~~

1. Identify mockup room construction on Contractor's construction schedule.

a. Coordinate early shop drawing submittal, fabrication, and delivery of all materials required for completion of rooms.
b. Coordinate early delivery of OFCI equipment required for completion of rooms.

2. Architect will review mockup rooms in stages as progress warrants, including completion of the following stages as a minimum:

a. Framing.
b. In-wall rough-in.
c. Ceiling rough-in.
d. Finishes.
e. CFCI and OFCI equipment installation.

3. Obtain approval for all field mockup rooms before starting fabrication or construction of production work. Completion and approval of mockup rooms will be required prior to application for payment for any production work.

R. Mockup In-Situ:

1. Patient Holding Headwall:

a. Prior to finalizing stud locations and roughing in utilities create a mock up of the layout of the headwall utility outlets, wall mounted equipment, and trim finishes. Mockup will be reviewed by Architect and Owner for the intent to adjust locations of the items to suite.
b. Mockup may be of cardboard or foam core over temporary framing. Equipment may be actual items or cutouts, but must be movable to allow adjusting locations. Mockup to be rigid enough to securely hold position during the time of review and documentation. Provide way to coordinate framing and rough-in with layout.
c. Document final layout including size of and dimensions to each item and stud locations and provide to Architect for acceptance prior to removing mockup.

2. Obtain approval for all field mockup rooms before starting fabrication or construction of production work. Completion and approval of mockup rooms will be required prior to application for payment for any production work.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Prior to installing any portion of the work, inspect the work in place that is to receive the work to be installed, and arrange for correction of defects in the existing workmanship, material or conditions that may adversely affect work to be installed. Include test applications of the materials to be installed as required to establish the correct condition of surfaces involved. Installation of materials on Work in place constitutes acceptance by the installing Contractor, subcontractor or sub-subcontractor of such work in place as being in proper condition to receive the materials to be applied and waiver of claim that the work in place is defective as pertains to warranty requirements, excluding unascertainable or concealed conditions. Where the Specifications require a material to be installed under the supervision or inspection of the material manufacturer or his representative, have the manufacturer or his representative also inspect the work in place and issue a letter of approval to the Owner's Representative.

1.8 QUALITY CONTROL (QC) ORGANIZATION

A. The QC program consists of preparing a QC Plan, fulfilling the duties of the QC Manager and preparing QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations that comply with the requirements of this Contract.

B. Quality Control (QC) Manager: Provide a QC Manager at the work site to manage and implement the QC program.; The QC Manager may share other project duties with the responsibility of managing and implementing the QC program. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC specialists. No work or testing may be performed unless the QC Manager or the designated Alternate QC Manager is on the work site. The QC Manager shall report directly to an officer of the firm and shall not be the same individual as, nor be subordinate to, the Project Superintendent or the Project Manager. QC Manager duties include:

1. Attend the QC Plan meetings.
2. Attend the Coordination and Mutual Understanding Meeting.
3. Conduct the QC meetings.
4. Perform the three phases of control.
5. Perform submittal review.
6. Ensure testing is performed.
7. Prepare QC certifications and documentation required in this Contract.

C. Alternate QC Manager Duties: Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year.

D. QC Specialists Duties and Qualifications: Provide a QC specialist at the work site for each of the areas of responsibilities, specified below, who shall assist and report to the QC Manager and who shall have no duties other than performing the three phases of control and preparing documentation required in this Contract. Pertinent QC specialists are required to attend the Coordination and Mutual Understanding Meeting, and QC meetings, perform the three phases of control, and prepare documentation for each definable feature of work in their area of responsibility at the frequency specified below. Where Qualifications/Experience for QC specialist is shown to be a manufacturer's technical representative the QC specialist shall not be an employee of the Contractor or any subcontractor performing the Work of the Project. The manufacturer's technical representative shall be experienced in the product's application and installation in a construction environment.

1. Section 087100: Hardware door frames & low voltage security, Fire Alarm.

    a. Hardware & door coordination: Certified Architectural Hardware Consultant (AHC).
    b. Area of Responsibility: Review and certification of hardware coordination effort.

2. Section 079200:

    a. Sealant Manufacturer's Technical Representative: 5 years minimum experience.
    b. Area of Responsibility: Installation of sealants.
    c. Frequency: Full time during Installation of Samples; minimum twice per week during installation.

E. Submittal Assistant's Review Duties:

1. Provide a Submittal Assistant at the work site until 95 percent of the submittals have been approved. Sole duty of the Submittal Assistant shall be to assist the QC Manager in processing, certifying QC compliance, and maintaining files for submittals.

1.9 QUALITY CONTROL (QC) PLAN

A. Requirements: Provide a QC Plan for approval by the Owner's Representative that covers both on-site and off-site work, and includes the following:

1. A chart showing the QC organizational structure and its relationship to the production side of the organization.
2. Names and qualifications, in resume format, for each person in the QC organization.
3. Duties, responsibilities and authorities of each person in the QC organization.
4. Documentation procedure, including proposed report formats for all reports required by this specification.
5. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract and that the QC Manager reports to an officer of the firm, someone other than the Contractor's Project Manager. Include in this letter the QC Manager's authority to direct the stopping, removal and replacement of non-conforming work.
6. Procedures for reviewing, approving and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.
7. Testing laboratory information requirements.
8. A Testing Plan and Log that include the tests required, referenced by the Specification Section and paragraph number requiring the test, test procedures and frequency, schedule activity number, and the person responsible for each test.
9. Procedures to identify, record, track and complete rework items, including schedule activity number.
10. A listing of outside organizations such as architectural and consulting engineering firms that will be employed by the Contractor and a description of the services and resumes of personnel these firms will provide.
11. A list of the definable features of work. A definable feature of work is a task, which is separate and distinct from other tasks and requires separate control requirements. As a minimum, unless approved by the Owner's Representative, consider each Section of the Specifications as a definable feature of work.
12. A personnel matrix showing, for each Section of the Specification, who will review and approve submittals, who will perform and document the three phases of control, and who will perform and document the testing.

B. Preliminary Work Authorized Prior to Approval: The only work that is authorized to proceed prior to the approval of the QC plan is mobilization of storage and office trailers and surveying. Contractor shall not proceed on other activities without written approval from the Owner's Representative.

C. Approval: Approval of the QC plan is required before the start of construction. The Owner's Representative reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work. The Owner's Representative reserves the right to interview any member of the QC organization at any time in order to verify his/her submitted qualifications.

D. Notification of Changes: Notify the Owner's Representative, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. The Owner's Representative must approve proposed changes prior to implementation.

1.10 QUALITY CONTROL (QC) PLAN MEETING

A. Prior to submission of the QC Plan, meet with the Owner's Representative to discuss the QC plan requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QC plan requirements prior to plan development and submission.

1.11 COORDINATION AND MUTUAL UNDERSTANDING MEETING

A. After submission of the QC Plan, but prior to the start of construction, meet with the Owner's Representative to discuss the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used for documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and QC personnel with the Owner's Representative, IOR, and Architect.

1. Attendees: As a minimum, the Contractor's personnel required to attend shall include the project manager, project superintendent, QC Manager, and QC specialists.
2. QC Manager will prepare meeting minutes. Minutes shall be signed by Contractor and the Construction Manager.

1.12 QUALITY CONTROL (QC) MEETINGS

A. After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the project superintendent and QC specialists. The topics required by this Section may be covered in conjunction with any weekly project meeting with the same attendees. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Owner's Representative within two working days after the meeting. The Owner's Representative and IOR may attend these meetings. The QC Manager shall notify the Owner's Representative at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

1. Review the minutes of the previous meeting.
2. Review the schedule and the status of work.

    a. Work or testing accomplished since last meeting.
    b. Rework items identified since last meeting.
    c. Rework items completed since last meeting.

3. Review the status of submittals:

    a. Submittals reviewed and approved since last meeting.
    b. Submittals required in the near future.

4. Review the work to be accomplished in the next 2 week(s) and documentation required. Schedule the three phases of control and testing:

    a. Establish completion dates for rework items.
    b. Preparatory phases required.
    c. Initial phases required.

d. Follow-up phases required.
e. Testing required.
f. Status of off-site work or testing.
g. Documentation required.

5. Resolve QC and production problems.
6. Address items that may require revising the QC plan:

a. Changes in QC organization personnel.
b. Changes in procedures.

1.13 THREE PHASES OF CONTROL

A. General: The QC Manager shall perform three phases of control to ensure that work complies with Contract requirements. The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each definable features of work: a definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements. For the purposes of this project the three phases of control will be limited to those Specification Sections listed in the Quality Control (QC) Organization Article of this Section.

B. Preparatory Phase: Notify the Owner's Representative at least 48 hours in advance of each Preparatory Phase meeting. Conduct a Preparatory Phase meeting with the QC specialists, the superintendent, subcontractor and the foreman responsible for the definable feature. Conduct Preparatory Phase meeting a minimum of 5 work days and a maximum of 10 work days prior to the scheduled start of work for the definable feature. The Owner's Representative, Architect and/or the IOR may attend these meetings. The QC Manager shall prepare minutes of the Preparatory Phase meeting and provide a copy to the Construction Manager within 2 working days after each meeting. Document the results of preparatory phase actions in the daily Contractor Quality Control Report. Perform the following tasks and submit a completed Preparatory Phase check off report to the Owner's Representative within 48 hours prior to beginning work on each definable feature of work.

1. Review each paragraph of the applicable specification sections.
2. Review the Contract drawings.
3. Verify the appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
4. Review the testing plan and testing schedule and ensure that provisions have been made to provide the required QC testing.
5. Examine the work area to ensure that the required preliminary work has been completed.
6. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data.
7. Review the Safety Plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.
8. Discuss construction methods and Construction Methods Form.

C. Initial Phase: Notify the Owner's Representative at least 48 hours in advance of each Initial Phase. When construction crews are ready to start work on a definable feature of work, conduct the Initial Phase with the QC specialists, the superintendent, and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the Initial Phase in the daily Contractor Quality Control Report. Repeat the Initial Phase for each new crew to work on-site, or when quality falls below specified acceptable levels. Perform the following for each definable feature of work.

1. Confirm the quality of workmanship required.
2. Resolve potential conflicts.
3. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met.
4. Ensure that testing is performed by the approved laboratory.

D. Follow-Up Phase: Perform the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work. Document in the daily Contractor Quality Control Report.

1. Ensure the work is in compliance with Contract requirements.
2. Verify the quality of workmanship required.
3. Ensure that testing is performed by the approved laboratory.
4. Ensure that rework items are being corrected.

E. Notification of Three Phases of Control for Off-Site Work: Notify the Owner's Representative at least two weeks prior to the start of the Preparatory Phase and Initial Phase.

1.14 QUALITY CONTROL (QC) CERTIFICATIONS

A. Contractor Quality Control Report Certification: Include the following statement for each Contractor Quality Control Report: "On behalf of the Contractor, I certify that this report is complete and correct, and that equipment and material used and work performed during this reporting period is in compliance with the Contract Drawings and Specifications to the best of my knowledge, except as noted in this report."

B. Invoice Certification: QC Manager shall furnish a certificate to the Owner's Representative with each payment request, signed by the QC Manager attesting that record drawings are current and attesting that the work for which payment is requested including stored material, is in compliance with contract requirements.

C. Completion Certification: Upon completion of all or a designated portion of the Work under this Contract, the QC Manager shall furnish a certificate to the Owner's Representative attesting that "the Work has been completed, inspected, tested and is in compliance with the Contract."

1.15 QUALITY CONTROL (QC) DOCUMENTATION

A. General: Maintain current and complete records of on-site and off-site QC program operations and activities.

B. Contractor Daily Report: Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. Identify reporting of work by terminology (activity number and description) consistent with the construction schedule. Contractor Daily Reports are to be prepared, signed, and dated by the project superintendent and shall include the following information.

C. Contractor Quality Control Report: Reports are required for each day that work is performed and for every seven consecutive calendar days of no-work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology and activity codes consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager and shall contain the following information.

1. Identify the control phase (preparatory, initial, follow-up) and the definable feature of work.
2. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the Drawings and Specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.
3. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed; include a list of who performed the tests.
4. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed; include a list of who performed the tests.
5. Results of the three phases of control for off-site work, if applicable, including actions taken.
6. List the rework items identified, but not corrected by close of business.
7. List the rework items corrected from the rework items list along with the corrective action taken.
8. Include a "remarks" section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that record drawings have been updated, corrective direction given by the QC organization and corrective action taken by the Contractor.
9. Contractor Quality Control Report certification.

D. Reports from the QC Specialist(s): Reports are required for each day that work is performed in their area of responsibility. QC specialist reports shall include the same documentation requirements as the Contractor Quality Control Report for their area of responsibility. QC specialist reports are to be prepared, signed, and dated by the QC specialist and shall be attached to the Contractor Quality Control Report prepared for the same day.

E. Testing Plan and Log: As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the IOR, remarks, and acknowledgement that an accredited or approved testing laboratory was used. Attach a current updated copy of the "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

F. Rework Items List: The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. Attach the current copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Owner's Representative, Architect, or IOR.

G. Record Drawings: The QC Manager is required to review the record drawings required by Division 01 Section "Project Record Documents" to ensure that record drawings are kept current on a daily basis, and marked to show precise locations of items or any deviations which have been made from the Contract Drawings. The QC Manager or QC Specialist assigned to an area of responsibility shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the record drawings prior to submittal to the Owner's Representative.

H. Report Forms:

1. The following forms are acceptable for providing the information required by this Article. While use of these specific formats is not required, any other format used shall contain the required information.

    a. Contractor Daily Report.
    b. Contractor Quality Control Report and Separate Continuation Sheets.
    c. Testing Plan and Log.
    d. Rework Items List.
    e. Construction Methods Form.
    f. QC Managers Preparatory Phase Check-off Report.

2. Transmit report forms via a method acceptable to the Owner's Representative.

1.16 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

1.17 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

A. Regulatory Requirements For Testing and Inspection: Comply with 2013 California Building Code (CBC) requirements and all other requirements of governing authorities having jurisdiction.

B. Inspections and Tests by Governing Authorities: Cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.

1. Such authorities include Office of Statewide Health Planning and Development (OSHPD) Public Works Department, Fire Department, and similar agencies.
2. Except as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.

C. Comply with 2013 California Administrative Code California Code (CAC) of Regulations, Title 24, Part 1, Section 7-151, and issue construction and verified compliance reports to OSHPD through the IOR, as required.

1.18 INSPECTIONS AND TESTS BY MANUFACTURER'S REPRESENTATIVES

A. Inspections and Tests by Manufacturer's Representatives: Cause all tests and inspections specified to be conducted by materials or systems manufacturers to be made.

1. Make all tests and inspections required by materials or systems manufacturers as conditions of warranty or certification of Work. Include the cost in the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Section 017329 "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014100 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 RELATIONSHIP BETWEEN CODES, ORDINANCES, AND STANDARDS AND THE DRAWINGS AND SPECIFICATIONS.

A. Authority: All codes, ordinances and standards referenced in the Drawings and Specifications shall have the full force and effect as though printed in their entirety in the Specifications.

B. Precedence:

1. Where specified requirements differ from the requirements of applicable codes, ordinances and standards, comply with the more stringent requirements.
2. Where the Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, the Drawings and Specifications shall take precedence so long as such increase is legal.
3. Where no requirements are identified in the Drawings or Specifications, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.

1.3 APPLICABLE CODES, LAWS, AND ORDINANCES

A. Building Codes:

1. Work shall meet or exceed the requirements of the latest adopted editions of the California Building Code (CBC), the California Fire Code, the California Plumbing Code (CPC), the California Mechanical Code (CMC), and the California Electrical Code (CEC), and as listed on the Drawings.
2. Work shall also comply with applicable requirements of California Code of Regulations (CCR) as follows:

    a. Title 8 - Industrial Relations.
    b. Title 19 - Public Safety.
    c. Title 22 - Social Security.
    d. Title 24 - Building Standards, Parts 2 through 12.

3. References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the codes specified above, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction.

B. Other Applicable Laws, Ordinances and Regulations:

1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of Federal, State and local governmental agencies, and jurisdictions having authority over the Project.
2. Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
3. Where such laws, ordinances rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to the execution date of the Agreement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014100

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

1. Words and terms not otherwise specifically defined in the Conditions of the Contract, in this Section, or in the Drawings and Specifications, shall be as customarily defined by trade or industry practice, by reference standard, and by specialty dictionaries such as Dictionary of Architecture and Construction (Cyril M. Harris, McGraw-Hill Book Company).

B. "All": Specified requirements apply to all work of the same type and class even though the word "all" may not appear.

C. "And/or": If used, shall mean that either or both of the items so joined are required.

D. "Applicable": As appropriate for the particular condition, circumstance, or situation.

E. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the General Conditions, in the professional judgment of the Architect and the Architect's responsible design consultants. Approvals shall only be valid if obtained in writing and shall not apply to matters regarding the means, methods, techniques, sequences and procedures of construction. Approval shall not release Contractor from responsibility to fulfill Contract requirements.t.

F. "Directed": A command or instruction by Architect or the Owner, in writing, regarding matters other than the means, methods, techniques, sequences and procedures of construction. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases. No implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's supervision of construction.

G. "Equal or Equivalent": As determined by the Architect as being equivalent, after consideration of quality, durability, finish, function, suitability, utility and performance.

H. "Indicated": Requirements expressed by graphic representations or in written form such as notes or schedules on Drawings, paragraphs or schedules in Specifications, and similar requirements in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated," and are used to help locate the reference.

I. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

J. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

K. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

L. "Installer": The Contractor or an entity engaged by the Contractor, as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. "Experienced Installer": The term "experienced," when used with "installer" means having successfully completed a minimum of 5 previous Projects similar in size to this Project, and being familiar with the precautions required and with requirements of the authority having jurisdiction.

M. "Jobsite": The same as "Site."

N. "Necessary": As determined in the professional judgment of the Architect as being necessary for the Work, in conformance with the requirements of the Contract Documents, and excluding matters regarding the means, methods, techniques, sequences and procedures of construction.

O. "Noted": The same as "Indicated."

P. "Per": In accordance with or in compliance with.

Q. "Products": Material, system, or equipment.

R. "Project Site": Same as "Site."

S. "Proper": As determined by the Architect as being proper for the Work, excluding matters regarding the means, methods, techniques, sequences and procedures of construction, which are solely the Contractor's responsibility to determine.

T. "Provide": Furnish and install, complete and ready for the intended use.

U. "Project Site": Space available for performing construction activities, either exclusively or with others performing other construction on the Project. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

V. "Regulation": Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, and rules, conventions and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

1. "Required":
2. As required by regulatory requirements of governing authorities.
3. As required by referenced standards.
4. As required by existing or job conditions.
5. As generally provided by accepted construction practice of the locale.
6. As indicated on the Drawings and in the Specifications.
7. As otherwise required by the Contract Documents.

W. "Scheduled": Same as "Indicated."

X. "Selected": As selected by Architect or Owner from the full national product selection of the manufacturer, unless otherwise specifically limited in the Contract Documents to a particular quality, color, texture or price range.

Y. "Shall": Means mandatory.

Z. "Shown": Same as "Indicated."

AA. "Testing Laboratories": Same as Testing and Inspection Agency.

BB. "Testing and Inspection Agency": An independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.

1.3 REFERENCE STANDARDS, GENERAL

A. References: The Drawings and Specifications contain references to various standards, standard specifications, codes, practices and requirements for products, execution, tests and inspections. These reference standards are published and issued by the agencies, associations, organizations and societies listed in this Section or identified in individual Sections of the Specifications.

B. Relationship to Drawings and Specifications: Such references are incorporated into and made a part of the Drawings and Specifications to the extent applicable.

C. Referenced Grades, Classes, and Types: Where an alternative or optional grade, class or type of product or execution is included in a reference but is not identified in the Drawings or Specifications, provide the highest, best and greatest of the alternatives or options for the intended use and prevailing conditions.

D. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision or amendment. It is presumed that the Contractor is familiar with and has access to these nationally- and industry-recognized specifications and standards.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. All amendments, changes, errata and supplements as of the effective date shall be included.

C. Jobsite Copies:

1. Obtain and maintain at the Project Site copies of reference standards, codes, and research reports identified on the Drawings and in the Specifications in order to properly execute the Work.
2. At a minimum, have the following readily available at the site:

a. Model Codes:

1) International Building Code (IBC).
2) International Fire Code (IFC).
3) Uniform Mechanical Code (UMC).
4) Uniform Plumbing Code (UPC).
5) NFPA 70-National Electric Code (NEC).
6) NFPA 101-Life Safety Code, including applicable amendments for jurisdiction in which Project is located.

b. State of California Codes:

1) California Code of Regulations (CCR) Title 24.
2) California Building Code (CBC).
3) California Electrical Code (CEC).
4) California Mechanical Code (CMC).
5) California Plumbing Code (CPC).
6) California Fire Code (CFC).

c. Safety Codes: State of California, Division of Industrial Safety regulations.
d. General Standards:

1) Model code standards.
2) UL Building Products Listing.
3) FM Approval Guide.
4) ASTM Standards in Building Codes.

e. Fire and Life Safety Standards: All referenced standards pertaining to fire rated construction and exiting.
f. Common Materials Standards: Standards of the following organizations, to the extent referenced within the Contract Specifications.

1) American Concrete Institute (ACI).
2) American Institute of Steel Construction (AISC).
3) American Welding Society (AWS).
4) Gypsum Association (GA).
5) National Fire Protection Association (NFPA).
6) Tile Council of North America (TCNA).
7) Woodwork Institute (WI).

g. Research and Evaluation Reports:

1) For All Products Used.

a) ICC Evaluation Service (ICC-ES) Reports (ESR).
b) Use ICC-ES (ESR #) designations.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
2. DOE - Department of Energy; www.energy.gov.
3. EPA - Environmental Protection Agency; www.epa.gov.
4. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
5. OSHA - Occupational Safety & Health Administration; www.osha.gov.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CBSC; California Building Standards Commission; www.bsc.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
4. CDHS; California Department of Health Services; (See CDPH).
5. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
6. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014533 - STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for structural tests and inspections for hospital construction.

B. Structural testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

C. Related Sections include the following:

1. Section 013200 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Section 017300"Execution" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 02 through 49 Sections for additional test and inspection requirements.

1.3 TESTING, GENERAL

A. Testing Agency or Laboratory:

1. Qualifications: Materials tests and inspections by Laboratory shall be under supervision of a California Registered Professional Engineer employed by a Testing Agency or Laboratory approved by the Architect, Owner, and OSHPD.
2. Materials Tested: Materials to be furnished for the Work are subject to testing and inspection for compliance with the requirements of the Contract Documents.
3. Test Standards: Testing Laboratory shall make all tests of materials in accordance with applicable standard methods of ASTM and procedures specified.

B. Tests Required and Samples:

1. Test materials required by the Contract Documents and others as directed by the Owner, Architect, or public authorities having jurisdiction of the Work.

2. Contractor shall furnish Samples of materials required to Testing Laboratory in a timely manner. Samples of materials to be tested will be selected by the Testing Laboratory or Owner, not the Contractor.
3. Do not incorporate materials represented by Samples under test into the Work without approval of the Architect.

C. Laboratory Test Reports:

1. Submit laboratory test reports for all tests made, whether such tests indicate that the material is satisfactory or unsatisfactory. Submit reports for Samples taken but not tested and records of sampling operations as required.

    a. The report shall show that the materials were sampled and tested in accordance with the requirements of the 2013 California Building Standards Code, Title 24, CCR, and the Contract Documents. Test reports shall show the specified design strength and state definitely whether or not the material or materials tested comply with the requirements.

2. Verification of Test Reports:

    a. Testing Laboratory shall submit to OSHPD a verified report in duplicate covering all of the tests which were required to be made by that agency during the progress of the Work according to Title 24.
    b. Furnish reports each time that the Work is suspended, covering the tests up to that time, and at the completion of the Work covering all tests.

D. Notification:

1. Notify Owner or Testing Laboratory of materials or products to be tested prior to fabrication, manufacture, or installation.
2. Deliver notice sufficiently in advance that the materials may be tested at the source of supply with no delay to the Work.

E. Testing Costs: Owner will pay for initial tests by an independent testing laboratory as required by the Contract Documents and the 2013 California Building Standards Code, Title 24 of the California Code of Regulations.

F. Retesting Costs: Costs for retesting any material that fails to pass the initial test shall be reimbursed to the Owner.

1.4 INSPECTIONS

A. Owner will pay for continuous and special inspections which shall be performed by Project Inspector or Special Inspectors (hereinafter called Inspector) as required by the Contract Documents and the 2013 California Building Standards Code, Title 24 of the California Code of Regulations.

1. During course of Work under inspection, each Inspector shall submit detailed reports relative to progress and condition of Work, stipulating dates and hours spent on the Project.

B. Continuous Inspection is Required:

1. An Inspector employed by the Owner in accordance with the requirements of the 2013 California Building Standards Code, Title 24, CCR will be assigned to the Work to perform the duties specifically defined in the Code. The Inspector shall have personal knowledge, obtained by continuous inspection of all parts of the Work of construction in all stages of its progress, to ensure that the Work is in accordance with the approved Drawings and Specifications, and shall have free access to all parts of the Work at any time.
2. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the Work and the character of the materials.
3. Inspection of the Work shall not relieve the Contractor of responsibility for compliance with the Contract Documents.
4. The Inspector and the Architect shall have authority to reject the Work whenever the provisions of the Contract Documents are not being complied with.

C. Excess Inspection Costs:

1. Contractor shall reimburse to Owner all excess inspection costs due to rejection of installed Work by Architect, Owner, or public authorities having jurisdiction or by Contractor's failure to coordinate the inspection with the Work.

1.5 DISTRIBUTION OF TEST AND INSPECTION REPORTS

A. Distribute copies of each test and inspection report as follows:

1. 1 copy: Owner
2. 1 copy: Architect
3. 1 copy: Structural Engineer
4. 2 copies: Contractor
5. 1 copy: OSHPD
6. 1 copy: Inspector

1.6 COORDINATION

A. The Contractor shall initiate and coordinate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities.

1.7 REQUIRED TESTS AND INSPECTIONS

A. Owner will pay for the following tests and inspections plus such others as are required by the 2013 California Building Standards Code, Volume 2, Part 2, Title 24, CCR.

B. Tests and inspections, as set forth in the following Sections of the applicable codes, will be required when referenced on the Testing, Inspection and Observation Program inserted at the end of this Section.

1.8 TESTING OF POWDER ACTUATED STUDS

A. Powder actuated studs may be used where indicated in the Contract Documents. Test powder actuated studs as follows:

1. Prequalification Tests:

a. Owner's Inspector shall prequalify operator, tool and fastener for each system using a testing device that has been calibrated by the Testing Laboratory.
b. Qualify the system by testing the first 10 fasteners of each type placed at a test load not less than 200 pounds (in tension).
c. Conduct load testing in such a manner as to not confine the spalling tendency of the concrete at the base of the fastener.

2. Random Tests:

a. Following prequalification, random tests shall be made under supervision of the Owner's Inspector for at least 1 out of every 10 fasteners placed.
b. Should failure occur on any fastener tested, all fasteners shall be tested and all unfair fasteners replaced at the Contractor's expense by reimbursement to the Owner.

1.9 TESTING AND INSPECTION REQUIREMENTS FOR HOSPITAL CONSTRUCTION

A. Tests:

1. The Owner will select and pay for an independent Testing Laboratory to conduct the tests. Selection of the material required to be tested shall be by the Laboratory or Owner and not by the Contractor.
2. For materials required to be tested, the Contractor shall notify the Owner, Architect a sufficient time in advance in order that the Owner may arrange for testing of same at the source of supply.
3. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed the required testing and inspection or prior to receipt of notice from the Architect that such testing and inspection will not be required shall not be incorporated in the Project.
4. The Owner will select and pay for testing laboratory cost for all tests and inspections, but may be reimbursed by the Contractor for such costs under the Conditions of the Contract.

B. Test Results: Testing Laboratory shall forward one copy of all tests reports to OSHPD. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 of CCR and with the approved specifications. Test reports shall show the specified design strength and also state definitely whether or not the material or materials tested comply with requirements. Reports shall include:

1. All tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory.

2. Samples taken but not tested.
3. Records of special sampling operations as required.

C. Verification of Test Reports: Each testing agency shall submit to OSHPD a verified report in duplicate covering all of the tests that were required to be made by that agency during the progress of the Project. Furnish reports each time that work on the Project is suspended, covering tests up to that time, and at completion of the Project.

D. Inspection by the Owner:

1. The Owner and his Consultants shall at all times have access for the purpose of inspection to all parts of the Work and to the shops where Work is being prepared. The Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
2. The Owner shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected. Rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the Owner may correct the Work and charge the expense to the Contractor.
3. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire Work to make an examination of Work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials.

    a. If such Work is found to be defective in any respect due to fault of the Contractor, he shall defray all expenses of such examination and of satisfactory reconstruction.
    b. If such Work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed to the Contractor.

E. Owner's Inspector:

1. Owner will employ an Inspector in accordance with the requirements of California Code of Regulations, Title 24. The Inspector's general duties are defined in Section 7-145 of the 2013 California Administrative Code, Part 1, Title 24, CCR.
2. The Work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector, who shall have access to all parts of the Work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary for the Inspector to be fully informed of the progress and manner of the Work and the character of materials.
3. Inspection of the Work shall not relieve Contractor of responsibility for compliance with the Contract Document requirements.

F. Temporary Field Office: The Contractor shall provide for the use of the Owner's Inspector, Owner, and Architect in a temporary office to be located as directed by the Inspector and maintained until removal is authorized by the Owner. This office shall be of substantial waterproof construction with adequate natural light and ventilation by means of stock design windows. Furnish and equip the office as follows:

1. One common space of at least 300 s.f. with an entrance directly to the outside for the Inspector.
2. One office of at least 100 s.f. with one entrance directly from the outside and one entrance into the common space.
3. One office of at least 100 s.f. with an entrance from the common space only.
4. Capabilities for a minimum of 50 l.f. of shelving storage divided equally between the two offices.
5. A plan table 3'-0" by 8'-0".
6. Two plan racks with provisions for 12 racks each.
7. Three desks of at least 3'-0" by 5'-0" size, with desk chairs.
8. Six side chairs divided equally between the two offices.
9. Eight 4 drawer lockable file cabinets.
10. A conference table and chairs suitable for project meetings, of a size to accommodate at least 8 people.
11. Three phone jacks (two lines, one located in office with direct exterior access, and the other line to have two jacks located one each in the remaining spaces.) Two dedicated phone jacks for fax machines, one in each office. Contractor to pay for local telephone service. Inspector's phone line shall include loud exterior bell.
12. Provide and pay for electrical power, lights, heat and cooling capabilities, and convenience outlets, all to the satisfaction of the Owner's Inspector.
13. Provide a way to secure the office spaces.
14. Provide and maintain toilet facilities dedicated for use by the Owner/Inspector.
15. Provide space for four parking spaces on site and adjacent to the above office spaces.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - EXHIBITS

A. TESTING, INSPECTION AND OBSERVATION PROGRAM FORMS

1. Attached Testing, Inspection and Observation Program (TIO) forms are incorporated herewith:

    a. PHASE 1
    b. PHASE 2
    c. PHASE 3
    d. PHASE 4

END OF SECTION 014533

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 013300 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Section 017300 "Execution" for progress cleaning requirements.
4. Divisions 02 through 49 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Installation, maintenance, and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Temporary Heat and Ventilation: Pay temporary heat and ventilation service charges used during construction, including costs of installation, power/fuel, operation, maintenance and removal of temporary apparatus.

1. Pay costs of power/fuel used by permanent heating system until date of Substantial Completion.
2. Should Owner occupy part of facility during construction, power/fuel costs will be shared proportionately, upon agreed unit costs.

F. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

G. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Submit layout of sign faces to Owner for review and approval. Accurately depict lettering styles, graphics and colors.

1.6 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.7 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, Chapter 11B of the 2013 California Building Code (CBC), andICC/ANSI A117.1.

D. Sign Painter's Qualifications: Sign painter shall be regularly engaged and specializing, for the preceding five years, in the design, execution, construction and installation of exterior signage of equivalent type, size and complexity.

E. Fire Protection: Provide fire protection program to minimize fire hazards within Project area. Until Acceptance, fire protection within Project area shall be solely the Contractor's responsibility. At a minimum, provide adequate fire protection devices, such as suitable fire extinguishers, blankets, warning signs and storage containers.

F. Hazardous Activities: During welding, brazing and other construction activities with high fire hazard, maintain fire protection devices immediately available for use at the location of such activities.

1.8 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

1. When any portion of the permanent systems are in operating condition, that part of the system may be used as a temporary facility, provided that the Contractor:

a. Obtains the Owner's approval.
b. Assumes full responsibility for the system used.

c. Pays all costs for operation, maintenance, cleaning and restoration of the system.
d. Operates the system under the supervision of the subcontractor responsible for the system installation and ultimate performance.

1) Operates the air circulating system without cooling, and:

a) Provide temporary approved filters to adequately filter all air (including return, transfer and outside air) being distributed through the ductwork to the supply outlets.
b) Place disposable filters in front of all return air and exhaust registers to keep construction dirt out of exhaust ductwork.

2) Installs in enclosed, heated and lighted building, temporary sanitary fixtures for all workers and remove portable toilet facilities from the premises.

a) Locate sanitary facilities in one designated toilet room or area of new construction.

2. Warranties shall not begin until Owner takes occupancy.

B. Locate temporary structures to avoid interference with work and as approved by Owner.

C. Relocate temporary structures as required by progress of the Work.

1.9 CODES AND REGULATIONS

A. General: Consider local building codes or other authority requirements and legal requirements for protection as minimum requirements; be responsible for the protection in excess of such minimum requirements as required.

B. Requirements of Regulatory Agencies:

1. Comply with requirements of regulatory agencies having jurisdiction.
2. Obtain and pay for permits required by governing authorities.

C. Safety Regulations: Comply with requirements of all applicable Federal, State and local safety rules and regulations. Contractor shall be solely responsible for jobsite safety.

D. Barricades and Barriers: Provide substantial barriers, guardrails and enclosures around work areas and adjacent to embankments and excavations for protection of workers and the public.

E. Noise Abatement Regulations: Comply with requirements of noise abatement regulations, such as through use of mufflers on powered equipment and scheduling of Work to permitted hours for noise produced by construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber and Plywood: Comply with requirements in Section 061000 "Rough Carpentry.•

B. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 MATERIALS FOR SIGNS

A. Sign Structure and Framing: Provide new materials, wood or metal, structurally adequate to support sign panel and suitable for specified finish.

B. Sign Surfaces: Minimum 3/4-inch thick, exterior grade, softwood plywood with medium or high density phenolic sheet overlay, standard large sizes to eliminate joints. Provide sheet thickness as required to span across framing members and provide even, smooth surface without waves or buckles.

C. Framing Connectors:

1. Available Products:

a. Harlen Metal Products, Inc.
b. KC Metals Products, Inc.
c. Simpson Strong-Tie Co., Inc.

D. Anchors and Fasteners, General: Unless otherwise indicated, provide fasteners of type, grade and class required for intended use and sized and spaced as required for loads and substrate.

1. Concealed locations: Steel with cadmium-plating or other rust-inhibitive coating, except at aluminum provide stainless steel only.
2. Exterior exposure, exposed in damp location or where built into exterior walls: Zinc-coated (galvanized) or stainless steel.

E. Construction Adhesive: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Powder-Driven Fasteners: Use only if approved by Engineer.

1. Standard and Product: ICC-ESR-2269; Hilti.
2. Power driven fasteners are generally permitted only where specifically indicated or in load-bearing installations

G. Paint: Exterior quality, gloss enamel, as customarily used for such sign paint, adequate to resist weathering and fading for the scheduled construction period.

2.3 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. IOR Field Office(s): Of sufficient size to accommodate needs of Inspector(s) of Record. Furnish and equip office(s) as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room(s) of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room(s) with conference table, chairs, and 4-foot square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.
2. Meet specified and code ventilation requirements of products stored.
3. Maintain temperatures specified in respective Specification Sections for product stored.

E. First Aid Facilities:

1. Provide facilities required by authorities having jurisdiction and in accordance with legal requirements.

2.4 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Make available temporary power, water, sewer, gas and other utility services necessary for the Work, subject to Owner's review and approval. Coordinate with Owner's on-site facilities operation staff the locations and methods of connections.

B. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Service Charges: Pay utility service charges for services delivered through temporary connections to existing utilities, for reasonable quantities necessary for the Work. Exercise energy and water conservation measures.

C. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.
b. Provide one telephone line(s) for Architect and Owner's Representative's use.
c. Provide one telephone line(s) for Inspector of Record's use in IOR's field office(s).
d. Provide one direct line instrument at first aid station.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.

g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

L. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
2. Memory: 4 gigabyte.
3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 22-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 02/110BaseT Ethernet.
7. Operating System: Microsoft Windows XP Professional or Microsoft Windows Vista Business.
8. Productivity Software:

a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
b. Adobe Reader 7.0 or higher.
c. WinZip 7.0 or higher.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Traffic Routing: Prior to start of Work, determine the routing of construction vehicles, and the safeguards and procedures necessary to carry out the Work. Obtain Owner's approval of such routing.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

1. Construction Parking: Parking immediately adjacent to existing building is extremely limited and strictly controlled for emergency vehicle access.

    a. Construction personnel shall park on the public roadway.
    b. Do not park construction vehicles in a manner to block or obstruct free access to ambulance, handicapped and fire vehicles.
    c. Do not park construction vehicles on public roadways unless approved by local police authorities.
    d. Temporary construction parking, for immediate loading and unloading of materials, tools and equipment, shall only be in locations designated by Owner.

2. Regulate and maintain order in connection with construction parking.
3. Keep construction loading and parking areas clear of construction debris, especially debris which might create slipping or tripping hazard, which might injure vehicle tires, and which might stain surfaces.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification and Temporary Signs: As directed, provide one painted Project identification sign, 4 feet high by 8 feet wide, identifying Project and principal parties responsible for design and construction as indicated on Drawings.
2. Provide graphic design, style of lettering, and colors as directed. Owner will prepare camera-ready sign face. Architect will provide digital image of rendered building to be reproduced in full color.
3. Assume 4 colors (CMYK) printing on sign.
4. Include corporate logos of parties identified on sign.
5. Format similar to sample at end of this section

6. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.
    b. Provide informational signs as required by governing authorities having jurisdiction.
    c. Provide adequate signage for safety, conformance to governing authorities having jurisdiction, and trade practices.
    d. Additional informational signs, as necessary for conduct of construction activities, may be displayed when in conformance with sign construction and graphic requirements specified in this Section. Owner may review such signs for conformity to these requirements.

7. Restrictions: Do not display any signs that are not specified above, in Division 01 Section "Phasing and Special On-Site Requirements," and as required by authorities having jurisdiction, without approval of Owner. Do not display any advertising signage or signage identifying Subcontractors and/or materials suppliers.
8. Sign Painting: Produce signage of size, colors, and lettering style consistent with Project graphics and use, as required by authorities having jurisdiction, and by professional sign painters.

    a. Sign Face Finish: Gloss enamel.
    b. Structure Finish: Paint exposed surfaces of supports and framing members one coat of primer and one coat of exterior paint, flat finish
    c. Lettering: Regular, sans serif typeface, comparable to Helvetica, Helvetica Condensed, or Letter Gothic.

9. Fabrication:

    a. Sign Panels: Shop painted and field installed. Paint back of panels and edges for complete weather resistance and finished appearance.
    b. Project Identification Sign Installation: Erect Project Identification Sign on site at a lighted location of high public visibility, adjacent to the main entrance to the site, as approved by Owner.

        1) Construct sign support structure in durable manner, with bolted connections.
        2) Install sign to portable structure on skids.

            a) Portable structure shall resist overturning force of wind.

        3) Paint all surfaces and edges of sign support structure with one coat of primer and one coat of exterior paint, semi-gloss finish, color as directed.

    c. Informational Sign Installation: Install informational signs for optimum visibility, as approved by Owner.

        1) Mount signs on portable sign structures or temporarily attached to surfaces of structure.

            a) Portable structure shall resist overturning force of wind.

2) Paint all surfaces and edges of sign support structure with one coat of primer and one coat of exterior paint, semi-gloss finish, color as directed.
3) Attachment methods to surfaces of structure shall leave no permanent disfiguration or discoloration on completed Work

10. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

K. Provide and maintain in conformance with Safety Regulations miscellaneous temporary construction aids required for the proper execution of the Work, including but not limited to:

1. Ladders, ramps and railings.
2. Scaffolds, hoists, bunkers.
3. Chutes, barricades, enclosures.
4. Platforms, swing staging, walks

L. Locate temporary construction aids in and about the Work in such positions as are practicable and where they will not interfere with the progress of the Work. Remove at completion of the Work.

M. Provide openings where required for moving in large pieces of equipment of all types.

1. Close and restore openings and finish after equipment is in place, in accord with Section 017300 "Execution."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

1. Brace and secure all parts of the Work against storm and accident.
2. Provide barriers and guardrails as required to provide for public safety, to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.
3. Obtain and pay for all required permits and inspections.

D. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

E. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies. See Details on Plans.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

F. Welding: Provide and maintain all forms of protection necessary to prevent damage resulting from welding to:

1. Previously installed materials and equipment.
2. Materials and equipment intended for use in the Work.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Maintain signs and supports in a neat, clean condition. Repair all damage and weathering to structure, framing and signage.
3. Relocate informational signs as required by progress of the Work.
4. In the event of loss or damage, promptly restore temporary construction facilities and controls by repair or replacement at no change in the Contract Sum or Contract Time.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove Project Identification Sign when directed.
3. Remove all informational signs, framing, supports and foundations prior to Substantial Completion.
4. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."
5. Clean and repair damage caused by installation or use of temporary facilities on public and private right-of-way.
6. Clean sidewalks, driveways and streets frequently to maintain public thoroughfares free of dust, debris and other contaminants.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; system completeness; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.
2. Section 014200 "References" for applicable industry standards for products specified.
3. Section 017700 "Closeout Procedures" for submitting warranties for Contract closeout
4. Other Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittals: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Furnish electronic copies of the OSHA Material Safety Data Sheets (MSDS) for transmittal to the Medical Center for all products containing a hazardous substance. Include MSDSs for adhesives, paints, sealants, and other similar products.

1.6 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Provide equipment and personnel to handle products by methods to prevent soiling, marring, or other damage.
5. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.8 SYSTEM COMPLETENESS

A. The Contract Documents describe the design intent for completed Work. The Contract Documents are not intended to be comprehensive directions on how to produce the Work.

B. Provide complete and fully functional equipment, systems, and assemblies. Provide all products and operations necessary to achieve the design intent described in the Contract Documents.

C. Notify the Architect when:

1. Elements essential to proper execution of the Work are discovered to be missing or misdescribed in the Contract Documents.
2. The design intent is not clear.

D. When an essential element is discovered as missing or misdescribed prior to receipt of bids or establishing negotiated Contract Sum, Architect will prepare Addendum or issue a Clarification so that all costs may be accounted for in the Contract Sum.

E. When an essential element is discovered as missing or misdescribed after execution of the Agreement, Contractor shall provide the element as though fully and correctly described and a no-cost Change Order will be issued.

1.9 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Interchangeability: To the fullest extent possible, provide products of the same kind from a single source. Products required to be supplied in quantity shall be the same product and interchangeable throughout the Work.
4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," Architect will make selection.

6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements or submit a Substitution Request a minimum of 10 days prior to receipt of Bids to provide a comparable product of another manufacturer. Comparable products or substitutions for Contractor's convenience will not be considered after 10 days before receipt of Bids unless otherwise indicated.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements or submit a Substitution Request a minimum of 10 days prior to receipt of Bids to provide a product of another manufacturer that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered after 10 days before receipt of Bids unless otherwise indicated.
3. Products List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Substitutions for Contractor's convenience will not be considered unless otherwise indicated.
4. Manufacturers List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the named manufacturers. Substitutions for Contractor's convenience will not be considered unless otherwise indicated.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
6. Reference Standards: Where Specifications name a product only by a reference standard, select any product meeting the standard, by any manufacturer. Submit product data including verification that product meets reference standard requirements.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013100 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
3. Section 013300 "Submittal Procedures" for submitting surveys.
4. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
5. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
6. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.
7. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work. For any proposed change in materials, submit Request for Substitution in accordance with procedures in Division 01 Section "Product Requirements."
4. Dates: Indicate to Owner and Architect when cutting and patching will be performed to allow for observation by Owner and Architect.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. General: Do not cut or alter the work of another contractor without written consent of Owner.
2. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

    a. Do not notch or cut any structural members without prior written approval of the Structural Engineer of record and OSHPD through Change Orders, unless specific details are provided on approved Drawings.

3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

4. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

5. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on RFI form provided.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Sandblasting: Sand blast existing surfaces to receive materials secured by cementitious, adhesive, or chemical bond (such as concrete, toppings, elastomeric coatings, plaster, mortar, etc.), and other surfaces as shown, specified, directed, or required for proper preparation of surfaces.

1. Completely remove existing finishes, stains, oil, grease, bitumen, penetrated mastics and adhesives including primers, and substances deleterious to bond or connection of new materials, and expose clean sound surfaces.
2. Employ wet sandblasting for interior surfaces, and for exterior surfaces where directed or necessary to prevent creation of a dust nuisance or required by Code.

I. Welding: Conform to the following requirements where welding is performed in existing facilities.

1. Protection During Welding: Conform to Title 8, CCR. Protect structure occupants and the public with portable, solid-vision barricades around locations where welding is performed. Provide signs warning against looking at welding operations without proper eye protection.
2. Fire Extinguishers: Maintain a fully charged Underwriters Laboratory (UL)-labeled minimum 10 pound ABC fire extinguisher at every location where welding is performed within the facilities.
3. Welding Smoke Control: Verify locations of existing smoke detectors. Perform welding operations by methods that produce the minimum amount of smoke and fuels. Furnish portable type smoke collection and ventilating equipment as required to prevent smoke and fume nuisances. Notify Owner a minimum of 48 hours in advance if temporary deactivation of any smoke detector is required to prevent false alarms from the welding operations. Deactivate detectors only during the time welding is actually in progress.
4. Fire Prevention: Before welding, examine existing construction and backing for presence of combustible materials and finishes, and for conditions where heat conduction in metals may bring adjoining materials to ignition temperature. Use positive fire prevention measures, including temporary removal asnd reinstallation of combustible materials, installation of temporary shields and heat sinks, and other necessary means. When actual field conditions are such that positive fire prevention measures cannot be achieved, notify Owner and do not proceed with welding operations until Owner has provided instructions.
5. Scheduling:

    a. Notify the Department of Building and Safety, Fire Safety Division, a minimum of 48 hours before start of any welding operations.
    b. Notify the Fire Department in writing a minimum of 2 weeks before start of any welding operations.

6. Provide a Fire Watch before start of any welding operations, and maintain in place a minimum of 4 hours after field welding operations are complete.

J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

   a. Roofing: Cut back to sound undamaged materials on straight lines and secure cut edges. Apply new roofing materials in repair areas of same type and finish as existing roofing, connected to existing roofing with waterproof connections. Refer to Division 07 roofing sections for furnishing and installing roofing materials.
   b. Waterproofing Membranes: Trim back to sound undamaged membrane, seal cut edges, and apply new waterproofing lapped 36 inches minimum on existing membranes using compatible and matching materials and methods. Refer to Division 07 waterproofing sections for furnishing and installing waterproofing materials.

6. Woodwork: Patch with new matching or undamaged removed materials.

K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials.
2. Provide containers on Project site for collection of waste materials and debris. Do not use hospital waste containers for construction waste.
3. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
4. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
5. Containerize hazardous and unsanitary waste materials separately from other waste in covered metal containers. Mark containers appropriately. Remove waste from premises daily and dispose of legally, according to regulations.
6. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site, adjacent areas, and public properties free of waste materials and debris caused by Work of the Project.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

a. Vacuum clean interiors when they are ready to receive finish painting.
b. If necessary to control dust, wet down dry materials and rubbish.
c. Continue vacuum cleaning as needed until Final Completion.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

1. Provide adequate ventilation during use of volatile or noxious substances.
2. Do not use hospital ventilation system to provide ventilation.
3. Shield discharge of volatile or noxious exhaust from air intakes of hospital mechanical systems.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Plywood and oriented strand board.
e. Wood trim.
f. Structural and miscellaneous steel.
g. Rough hardware.
h. Insulation.
i. Doors and frames.
j. Door hardware.
k. Windows.
l. Glazing.
m. Metal studs.
n. Gypsum board.
o. Acoustical tile and panels.
p. Carpet.
q. Carpet pad.
r. Equipment.
s. Cabinets.
t. Plumbing fixtures.
u. Piping.
v. Supports and hangers.
w. Valves.
x. Sprinklers.
y. Mechanical equipment.
z. Refrigerants.
aa. Electrical conduit.
bb. Copper wiring.
cc. Lighting fixtures.
dd. Lamps.
ee. Ballasts.
ff. Electrical devices.
gg. Switchgear and panelboards.
hh. Transformers.

2. Construction Waste:

a. Lumber.
b. Wood sheet materials.
c. Wood trim.
d. Metals.
e. Insulation.
f. Carpet and pad.
g. Gypsum board.
h. Piping.
i. Electrical conduit.
j. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.

4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

C. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from recycled materials.
5. Savings in hauling and tipping fees by donating materials.
6. Savings in hauling and tipping fees that are avoided.
7. Handling and transportation costs. Include cost of collection containers for each type of waste.
8. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. OSHPD final inspection and project closeout.
3. Plumbing project check list for closeout.
4. Mechanical project check list for closeout.
5. Electrical project check list for closeout.
6. Fire- and life-safety systems check list for closeout.
7. Warranties.
8. Final cleaning.

B. Related Sections include the following:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographs and negatives.
3. Section 017300 "Execution" for progress cleaning of Project site.
4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
6. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.
7. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, final property surveys including Owner-accepted deviations from lines and levels indicated on the Drawings, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor in writing of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion on AIA document G704 after inspection or will notify Contractor in writing of items, either on Contractor's list or by other means of additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Remedy the deficiencies and certify in writing to the Architect when work is complete.
2. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
3. Results of completed inspection will form the basis of requirements for Final Completion.

C. When Architect and Owner agree that Work is substantially complete, Architect will submit the Certificate of Substantial Completion to the Owner and Contractor, for their written acceptance of the responsibilities assigned to them in the certificate.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit evidence of compliance with requirements of Authorities Having Jurisdiction including, but not limited to:

    a. Certificate of Inspection.
    b. Certificate of Occupancy.
    c. Health Department Certification.

5. Submit pest-control final inspection report and warranty.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect, will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor in writing of construction that must be completed or corrected before certificate will be issued.

1. Remedy the deficiencies and certify in writing to the Architect when work is complete.
2. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use form approved by Architect.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.6 OSHPD FINAL INSPECTION AND PROJECT CLOSEOUT

A. The Inspector of Record (IOR) will carefully review the Drawings, Specifications, Addenda, and Change Orders for special items not listed in this Section.

B. Preliminary punch list compiled by the IOR.

C. Preliminary punch list completed by the Contractor and subcontractors.

D. Final Approval of Work per Section 7-155 of Part 1, Title 24, 2013 California Code of Regulations:

1. OSHPD will schedule a final state agency inspection of the work subsequent to the receipt of the responsible Architect's statement that the Contract is performed or substantially performed.
2. OSHPD will issue final approval of the construction when:

    a. All work has been completed in accordance with the approved Construction Documents.
    b. The required verified reports and test and inspection reports have been filed with OSHPD.
    c. All remaining fees have been paid to OSHPD.

3. Final approval will be confirmed by a letter sent to the Department of Health Services with a copy to the applicant. The letter shall state that the work has been constructed in accordance with the 2013 California Building Standards Code, Title 24, California Code of Regulations.
4. Upon completion of the project, all copies of construction procedure records as required by Section 7-145 (a) 6 of Part 1, Title 24, 2013 CCR will be transmitted to OSHPD.

E. Architect of Record has sent letter to OSHPD with a statement that the Contract is performed or substantially performed.

F. Punch list is scheduled.

G. Punch list participants:

1. Architect.
2. Structural Engineer.
3. Mechanical Engineer.
4. Electrical Engineer.
5. Contractor.
6. Inspector of Record (IOR).
7. Owner's Representative.
8. Other participants.

H. Punch list distributed to all participants.

I. Punch list completed and all work completed in accordance with the approved Construction Documents.

J. Architect of record will ensure that final verified compliance reports have been submitted to OSHPD in compliance with Section 7-151 of Part 1, Title 24, 2013 CCR. In accordance with Section 7-151 (e), or when required by OSHPD, the Architect(s), Engineer(s), Inspector(s) of Record, Special Inspector(s) and Contractor shall each submit to OSHPD a verified compliance report, with their original signature and based on their personal knowledge as defined by Section 7-151, that the work has been performed and materials used and installed are in accordance with the approved Drawings and Specifications, including statements of fact as required by OSHPD.

K. Test and inspection reports filed with OSHPD.

L. Owner has paid remaining fees to OSHPD.

M. OSHPD letter stating that the work has been constructed in accordance with the 2013 California Building Standards Code, Title 24, California Code of Regulations has been sent to the Department of Health Services with a copy to the applicant (Owner).

N. All Change Orders have been approved #1 to #.

O. Approval of the air and water balance sheets has been received from OSHPD.

P. Hospital policies and procedures manual has been completed.

Q. Final written approval from OSHPD Fire Marshal (OFM).

R. Final approval from the local Fire Marshal.

S. Hospital administration has notified Health Services, Licensing and Certification for their site visit date.

T. Health Services, Licensing and Certification correction items completed.

U. Records of construction procedures sent to OSHPD as required by Section 7-145 (a) 6 and Section 7-155 (d) of Part 1, Title 24, 2013 CCR.

1. Records of times and dates of placing concrete.
2. Records of time and date of removal or correction phase of forms in each portion of the structure.
3. Location of defective concrete and manner of correction of defects.
4. Records of test reports of all nonconforming materials or defective workmanship with indication of the corrective action taken.
5. Records of driven piles used in foundations.

V. Testing Laboratory final report, single letter, sent to OSHPD.

W. If radiation shielding is required, original of Radiation Physicist Report sent to OSHPD office in Sacramento.

X. Clearance from Public Works. (City, County)

Y. Heliports - Helistops: Clearances from FAA, Cal-Trans, and other Authorities Having Jurisdiction.

Z. Diesel Generators: Clearance from the EPA when required to have a permit.

1.7 PLUMBING PROJECT CHECK LIST FOR CLOSEOUT

A. Medical Gas Systems:	Dates
24 hour pressure tested for all medical gas systems by Air Compliance Advisor (ACA) and Inspector of Record (IOR)	_____
Alarm systems tested by OSHPD Fire Marshal	_____
Zone valves, location, tagged, alarms tested	_____
Laboratory testing affidavits: Welding/brazing, purity, cross connections, alarm systems.	_____
Approved drawings on site, check entire systems from source to outlets.	_____

B. Piping Systems Pressure Tested:	Dates
Domestic water system, hot and cold.	_____
Natural gas.	_____
Vent and waste systems.	_____
Chill water supply and return.	_____
Low pressure steam, supply and return.	_____
Domestic water sterilization certification by independent laboratory. Note: IOR will document the taking of samples and record. A copy of the test results will be placed in file and original sent to OSHPD in Sacramento.	_____
Water heater temperature testing and alarm testing.	_____
Equipment instruction for the Owner's authorized Representative.	_____
A complete package of guarantees, warranties, operation instructions and diagrams.	_____
Record drawings signed by the Mechanical Engineer.	_____

Record drawings completed and given to the Owner. _____

1.8 MECHANICAL PROJECT CHECK LIST FOR CLOSEOUT

A. Heating, Ventilating and Air Conditioning Systems Dates

Air balance and water balance completed and certified by a registered professional engineer. _____

Air and water balance sheets signed by the Mechanical Engineer of Record. _____

Air and water balance sheets forwarded to OSHPD. (Requires OSHPD approval and acceptance). _____

Fire dampers tested and approved by OSHPD Fire Marshal. _____

Smoke dampers and alarm signal which indicated a closed damper have been tested and approved by the Deputy OSHPD Fire Marshal. _____

AC unit condensate drainage has overflow protection. _____

Mechanical Engineer's check and approval of performance of all mechanical work including color coding of lines, tagging of valves, air balance sheets, testing and adjustment of safety equipment, etc. _____

Equipment instructions for the Owner's authorized Representative. _____

A complete package of guarantees, warranties, operation instructions and diagrams. _____

Record drawings signed by the Mechanical Engineer of Record. _____

Record drawings completed and given to the Owner. _____

1.9 ELECTRICAL PROJECT CHECK LIST FOR CLOSEOUT

A. Electrical and Communication Systems Dates

Punch list items have been completed _____

Exit light locations and operating on emergency power. _____

Smoke detectors are on emergency power. _____

System grounding electrode testing and certification _____

Ground fault interrupter testing and certification. _____

Receptacle polarity testing and certification. _____

Equipotential ground testing and certification. _____

Motor load current adjustment and certification. _____

Isolated ground monitor testing and certification. _____

Emergency generator testing and certification. _____

Fire alarm system tested by OSHPD Fire Marshal _____
(See Fire- and Life-Safety Systems Check List below)

Power tie-in accepted by local jurisdiction. _____

Code blue system tested and connected to emergency power. _____

Door closing devices are operational on 1-hour corridors. _____

Electrical panel lists show room numbers served and _____
each circuit is spelled out for area or item served.

Junction boxes are labeled for circuit and use. _____

Medical gas alarms are operational. _____

Nurses call system is operational. _____

Personnel training of nursing staff and hospital _____
maintenance personnel.

A complete package of guarantees, warranties, operation _____

instructions, and diagrams received by Owner.

Record drawings completed, signed by the Electrical Engineer and given to the Owner. _____

Electrical Engineer's approval of all work, identification of circuits, testing and adjustment of safety equipment, fire alarm equipment, etc. _____

1.10 FIRE LIFE SAFETY SYSTEMS

A. Fire dampers: Furnish manufacturer's installation instructions. Inspect dampers in presence of IOR and OFM.

			Dates
1 Hour:	OFM	10%	_____
	IOR	100% check all	_____
2 Hour:	OFM	100% check all	_____
	IOR	100% check all	_____
Smoke	OFM	100% check all	_____
	IOR	100% check all	_____

B. Fire Sprinklers: OSHPD and OFM approved drawings on site. Dates

Underground pressure test at 200 psi; include hydrostatic testing. _____

Witness underground flush prior to connection. _____

Hydrotest at 200 psi for 2 hours for overhead piping. _____
Inspection of bracing and hangers. _____

Flow alarm check; tamper switch check. _____

Final inspection: Signs in place, fire extinguishing system flow alarm approval. _____

Exit light location checked and connected to emergency power. _____

C. Fire Alarm Systems: Approved drawings on site. Dates

Complete test of the entire fire protective signaling system including activation of all initiating devices, and signaling and detection devices. _____

D. Exit Corridors: Dates

Construction: Walls, UL design #. _____

Doors and windows: Protected openings, labels, gaskets, self closures, magnetic, etc. _____

Electrical boxes: No back to back boxes; horizontal separation 24 inches minimum; boxes larger than 100 square inches wrapped. _____

E. Fire Wall Penetrations: Need UL designs for firestopping methods. Dates

Corridors, 2 hour walls, smoke barrier walls, occupancy separations. _____

Finish materials approved for flame spread, fuel contribution, and smoke developed ratings. _____

F. Emergency Lighting: Dates

Generator test. _____

Emergency lights. _____

G. Kitchen hood fire suppression systems: Approved drawings on site. Dates

System tested with a written acceptance from the OSHPD Fire Marshal. _____

1.11 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Form of Warranty:

    a. Submit the warranties, typed on the Contractor's letterhead if for the entire Work, or on the subcontractor's letterhead if for the Work of a Specification Section, to the Owner for review.
    b. Use warranty form at the end of this Section.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in a hospital or health care facility cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations and conduct inspection of sight-exposed interior and exterior surfaces, and accessible concealed spaces before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project.

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, grease, fingerprints, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning..

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

2. Maintain Project in clean condition, ready for occupancy, until occupied by Owner.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 WARRANTY FORM

A. As a condition precedent to certification of final payment under this Contract, Contractor shall warrant in writing to Owner and Architect that it will repair or replace work that may prove defective or fail to conform to the Contract requirements or specified workmanship and materials; together with other work that may be displaced, damaged or marred in so doing, with the exception of ordinary wear and tear or unusual abuse or neglect. Repair and replacement shall be at Contractor™s expense. All warranties, unless greater requirements are otherwise stipulated in Contract Documents, shall be for one year period, dated from date of Substantial Completion.

B. Warranties shall be in the following form written on Contractor™s own letterhead.

Warrant _____(phase or portion of work warranted)

Project _____

Address _____

Date _____

We hereby warrant the _____which we have provided in the _____has been performed in accordance with the Contract Documents and that the work provided will fulfill the requirements of the warranty. We agree to repair or replace any or all of our work, that may prove to be defective in its workmanship, materials, or fail to conform to Contract requirements together with any other work which may be damaged or displaced by so doing, within a period of _____year(s) from date of Substantial Completion of the above-named Project by _____, without any expense whatever to the said _____, ordinary wear and tear and unusual abuse or neglect excepted. In the event of our failure to comply with the above-mentioned conditions within 30 days after being notified in writing by _____, we collectively or separately do hereby authorize_____ to proceed to have said defects repaired and made good at our expense and we will honor and pay costs and charges therefore upon demand.

_____ _____

Signature of General Contractor Signature of Subcontractor

_____ _____

Address and Phone Number Address and Phone Number

_____ _____

Date Date

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

B. Related Sections include the following:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 017700 "Closeout Procedures" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit 1 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Make submittals directly to the Architect. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 1 copies of each manual in final form at least 15 days before final inspection. Make submittals directly to the Architect. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Cover

2. Title page.
3. Table of contents.
4. Manual contents.

B. Cover: Provide front and back covers for each manual, using durable material and with the following information visible on or through the front cover:

OPERATION AND MAINTENANCE MANUAL

NAME OF PROJECT

(--------Description of Equipment or System--------)

Manual reviewed by

_____ _____
Architect Date

C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Neatly typewritten or printed; prepared on 8-1/2-by-11-inch white bond paper, 20 pound weight minimum.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

6. Measurements: Unless otherwise directed, provide all measurements in U.S. standard units such as inches and pounds.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

    a. Record Shop Drawings and Samples.
    b. Submittal log.
    c. Change Orders and other written amendments to the Contract.
    d. Field test and inspection records.
    e. Job meeting notes.
    f. Written communications and memos of verbal communications.
    g. Other miscellaneous record submittals as designated by Architect.

B. Related Requirements:

1. Division 01 Section "Execution" for final property survey.
2. Division 01 Section "Closeout Procedures" for general closeout procedures.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: At completion of Project, deliver record documents to Architect. Submit record documents in electronic format and hardcopy paper format; include information from all trades.

1. Label each record document on first page or sheet "PROJECT RECORD• " in 2 inch high printed letters.
2. Accompany each submittal with letter of transmittal including the following:

    a. Project name and number.
    b. Date.

c. Name of Architect.
d. Name and address of Contractor.
e. Title and number of each record document.
f. Certification that each document as submitted is complete and accurate, signed by Contractor or his authorized representative.

3. A reference by number to a Change Order, RFI, RFQ, Construction Change Directive, or other document is not sufficient as record information on any record document.

B. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one of file prints.
2) Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
3) Architect will return plots and prints for organizing into sets, printing, binding, and final submittal.

b. Final Submittal:

1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

C. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous Record Submittals: Submit annotated PDF electronic files and directories of each submittal.

F. Record Document Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below main floor level or survey datum.
    d. Locations and depths of underground utilities referenced to permanent surface improvements.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities referenced to visible and accessible features of structure.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with fine ball-point colored pens for marking. Use red and other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

    a. See Division 01 Section "Submittal Procedures" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in 2 inch high printed letters in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name and number.
    b. Date.
    c. Designation "PROJECT RECORD DRAWING."
    d. Name of Architect.
    e. Name and address of Contractor.
    f. Title and number of each record Drawing.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and other Contract modifications, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and other Contract modifications, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Legibly mark changes made after review. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

C. Miscellaneous record submittals include, but are not limited to, the following:

1. Record Shop Drawings and Samples.
2. Submittal log.
3. Change Orders and other written amendments to the Contract.
4. Field test and inspection records.
5. Job meeting notes.
6. Written communications and memos of verbal communications.
7. Other miscellaneous record submittals as designated by Architect.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Owner's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Section 012100 "Allowances."

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.

c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to .mp4 format file type, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.

4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

END OF SECTION 017900

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner's Project Requirements and Basis-of-Design documentation are included by reference for information only.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.

1.3 ALLOWANCES

A. Labor and management costs for the performance of commissioning.

B. The following are excluded from the commissioning allowance:

1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.
3. Work to correct commissioning issues.
4. Work to repeat tests when equipment and systems fail acceptance criteria.

1.4 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis-of-Design Document: A document prepared by Owner, Architect, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in Section 011000 "Summary."

F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:

    a. Completion of tests and acceptance of test results.
    b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    c. Comply with requirements in Section 017900 "Demonstration and Training."
    d. Completion and acceptance of submittals and reports.

G. Owner's Project Requirements: A document written by Owner, Architect, or Commissioning Authority that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.5 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.
2. Failure to meet acceptance criteria for test demonstrations.

B. Contractor shall compensate Owner for such additional services and expenses at the rate of $150.00 per labor hour plus $500.00 per round trip for personnel travelling more than 200 miles plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.6 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning.
2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.
3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

1.7 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for construction schedule general requirements for commissioning.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. Commissioning Coordinator Letter of Authority:

1. Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:

a. Make inspections required for commissioning.
b. Coordinate, schedule, and manage commissioning of Contractor, subcontractors, and suppliers.
c. Obtain documentation required for commissioning from Contractor, subcontractors, and suppliers.
d. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.

F. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.

1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

G. List test instrumentation, equipment, and monitoring devices. Include the following information:

1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
2. Brief description of intended use.
3. Calibration record showing the following:

    a. Calibration agency, including name and contact information.
    b. Last date of calibration.
    c. Range of values for which calibration is valid.
    d. Certification of accuracy.
    e. N.I.S.T. traceability certification for calibration equipment.
    f. Due date of the next calibration.

H. Test Reports:

1. Pre-Startup Report: Prior to start up of equipment or a system, submit signed, completed construction checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

I. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.8 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:

    a. Pre-startup reports.
    b. Approved test procedures
    c. Test data forms, completed and signed.
    d. Progress reports.
    e. Commissioning issues report log.
    f. Commissioning issues reports showing resolution of issues.
    g. Correspondence or other documents related to resolution of issues.
    h. Other reports required by commissioning.
    i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.

j. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction Phase Commissioning Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.
2. Certification of commissioning process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.

a. Certified Commissioning Professional, by Building Commissioning Association.
b. Commissioning Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
c. Accredited Commissioning Process Authority Professional, by University of Wisconsin.
d. Accredited Commissioning Process Manager, by University of Wisconsin.
e. Accredited Green Commissioning Process Provider, by University of Wisconsin.

B. Calibration Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

1.10 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Commissioning Authority Responsibilities: Comply with requirements in Section 011000 "Summary."

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning shall comply with the following criteria:

1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
2. Calibrated and certified.

    a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags permanently affixed.
    b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.

3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:

a. Test specification.
b. Pre-startup reports.
c. Approved test procedures.
d. Test data forms, completed and signed.
e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

A. Construction checklists cannot modify or conflict with the Contract Documents.

B. Create construction checklists based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment, if applicable.

1. Services connection requirements, including configuration, size, location, and other pertinent characteristics.
2. Included optional features.
3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness and lack of damage.
4. Installation Checks:

a. Location according to Drawings and approved Shop Drawings.
b. Configuration.
c. Compliance with manufacturers' written installation instructions.
d. Attachment to structure.
e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
f. Utility connections are of the correct characteristics, as applicable.
g. Correct labeling and identification.

h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, minimum.

E. Performance Tests:

1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, deferred construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:

1. Identify deferred construction checklists by number and title.
2. Provide a target schedule for completion of deferred construction checklists.
3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.

G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, delayed construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:

1. Identify delayed construction checklist by construction checklist number and title.
2. Provide a target schedule for completion of delayed construction checklists.
3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.

1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.

    a. General Inspection: Level I.
    b. Special Inspection: Level S-1.
    c. Acceptance Quality Limit (AQL) of 1.5.

2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning-Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning, including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.
2. Obtain, assemble, and submit commissioning documentation.
3. Conduct periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the construction schedule. Update schedule at specified intervals.
5. Review and comment on preliminary test procedures and data forms.
6. Report inconsistencies and issues in system operations.
7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by Owner's witness.

10. Coordinate and manage training. Be present during training sessions to direct video recording, present training and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.

B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published commissioning schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning.

C. Construction Checklists:

1. Complete construction checklists as Work is completed.
2. Distribute construction checklists to installing contractors before they start work.
3. Installers:

    a. Verify installation using approved construction checklists as Work proceeds.
    b. Complete and sign construction checklists daily for work performed during the preceding week.

4. Provide Commissioning Authority access to construction checklists.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.

F. Test Procedures and Test Data Forms:

1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
3. Completed test data forms are the official records of the results of tests.
4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
5. Review preliminary test procedures and test data forms and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

    a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
    b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.

4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.

    a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.

7. False load test requirements are specified in related sections.

    a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction Phase Commissioning Completion as follows:

    a. Identify deferred tests by number and title.
    b. Provide a target schedule for completion of deferred tests.

2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction Phase Commissioning Completion. Include the following in the request for Certificate of Construction Phase Commissioning Completion:

    a. Identify delayed tests by test number and title.
    b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.

2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

    a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
    b. Submit commissioning compliance issue report form within 24 hours of the test.
    c. Determine the cause of the failure.
    d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.

a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.

6. Diagnose and correct failed test demonstrations as follows:

a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
c. Record the results of each step of the diagnostic procedure.
d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
e. Determine and record corrective measures.
f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
b. For each repeated test demonstration, submit a new test data form, marked "Retest."

8. Do not correct commissioning compliance issues during test demonstrations.

a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than five minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 COMMISSIONING MEETINGS

A. Commissioning Authority will schedule and conduct commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

3.7 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. Construction Checklists:

    a. Material checks.
    b. Installation checks.
    c. Start up, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
    d. Performance Tests:

        1) Static tests, as appropriate.
        2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
        3) Equipment and assembly performance tests.
        4) System performance tests.
        5) Intersystem performance tests.

2. Commissioning tests.

B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.8 SCHEDULING

A. Commence commissioning as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule. See Section 013200 "Construction Progress Documentation."

1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.
2. Schedule the start date and duration for the following commissioning activities:

    a. Submittals.
    b. Preliminary operation and maintenance manual submittals.
    c. Installation checks.
    d. Startup, where required.
    e. Performance tests.
    f. Performance test demonstrations.
    g. Commissioning tests.
    h. Commissioning test demonstrations.

3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
4. Determine milestones and prerequisites for commissioning. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short interval schedule submittals.

C. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.
2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

D. Owner's Witness Coordination:

1. Coordinate Owner's witness participation via Architect.
2. Notify Architect of commissioning schedule changes at least two work days in advance for activities requiring the participation of Owner's witness.

3.9 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

    a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
    b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.

c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:

a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
c. Signatures of individuals performing and witnessing tests.
d. Data trend logs accumulated overnight from the previous day of testing.

3. Commissioning Compliance Issues Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:

a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
b. Action distribution list.
c. Report date.
d. Test number and description.
e. Equipment identification and location.
f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
k. Schedule for retesting.

4. Weekly progress reports include information for tests conducted since the preceding report and the following:

    a. Completed data forms.
    b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
    c. Activities scheduled but not conducted per schedule.
    d. Commissioning compliance issue report log.
    e. Schedule changes for remaining Commissioning-Process Work, if any.

5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.

    a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
    b. Attach to the data form printed trend log data collected during the test or test demonstration.
    c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.

6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."

    a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION PHASE COMMISSIONING COMPLETION

A. When Contractor considers that construction phase commissioning, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction phase commissioning or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction Phase Commissioning Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction Phase Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction phase commissioning completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction phase commissioning or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction Phase Commissioning that shall establish the date of completion of construction phase commissioning. Certificate of Construction Phase Commissioning Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 019113

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 013233 "Photographic Documentation" for preconstruction photographs taken before selective demolition operations.
3. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Removed material not otherwise designated for salvage, use or reuse, and debris from work of this Section, becomes the property of the Contractor. Contractor shall remove this material and debris from the site.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination.".

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations. Schedule work to coordinate with work performed by other trades.
5. Review areas where existing construction is to remain and requires protection.
6. Review procedures for noise control and dust control.
7. Review items to be salvaged and returned to Owner. Verify that removal of items to be salvaged will be by or under the direction of personnel who would normally install these items.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For demolition firm and professional engineer.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as manner to prevent damage caused by selective demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work beginsand promptly return to Owner.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Section 011000 "Summary."

B. Owner assumes no responsibility for actual condition of items or structure to be demolished. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

1. Take into account all such existing conditions and limitations whether or not specifically indicated in the Contract Documents.
2. Include necessary facilities and personnel to complete the Work in every part as shown, described, or reasonably implied by the Contract Documents.

D. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

F. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

G. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

H. Location of Existing Underslab and Underground Utilities: Determine location of existing underslab piping and electrical conduit using appropriate imaging systems necessary to determine type of utility and location in plan prior to laying out the new work. Provide depths at points of connections where possible. If needed as part of imaging system, coordinate use of tracers with facility as required for interruptions.

1. Methods to include EMF tracer on conductive utilities, introducing EMF signals down non-conductive utilities, pulsed sonic systems, ground penetrating x-ray and radar and similar appropriate systems. Propose methods for review prior to implementing. Proposal shall include summary of potential impacts on facility operations.

2. Provide plan drawing showing locations of utilities relative to building grid lines and remaining features. Provide depths of utilities at points of connection.
3. Update plan drawings with surveyed locations and depths at points of connection after utilities are exposed.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

3.3 PREPARATION

A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Cease operations and notify Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination for continuing operations is made.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Protect glass to prevent breakage. Replace all broken glass in kind at no additional cost to Owner.
5. Cover and protect furniture, furnishings, and equipment that have not been removed.
6. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Use of explosives will not be permitted.
3. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Do not damage existing reinforcing to remain.
4. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Do not use a jack hammer. Temporarily cover openings to remain.

    a. Where openings are cut oversize or in improper location, replace excess removed material with new, at no additional cost to the Owner.

5. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
6. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Promptly repair damage caused to adjacent facilities by demolition and alteration work at no additional cost to Owner.
12. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until reinstalled.
4. Protect items from damage during transport and storage.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

~~A.~~B. Cutting and Coring Concrete: Prior to cutting or coring concrete slabs or structural members locate existing reinforcing steel using detection or imaging system appropriate for thickness of concrete and access to the subject area.

~~B.~~C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

a. Throwing, dropping, or permitting the free fall of material and debris from heights which would cause hazards, damage, undue noise or nuisance, or excessive dust, is prohibited.

4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING AND RESTORATION

A. Leave affected areas of structure broom clean, with ledges and corners properly cleaned.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items to Be Removed and Salvaged: Remove and Reinstall exterior clear glazing and spandrel panels.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Formwork for cast-in-place concrete and shotcrete.
2. Installation of cast-in anchors, sleeves and similar items furnished under other Sections.

B. Related Sections include the following:

1. Section 033000 – Cast-in-Place Concrete.
2. Section 053100 – Steel Decking for leave-in-place formwork for deck-slabs.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 301.

C. American Concrete Institute's:

1. ACI 117 – Specifications for Tolerance for Concrete Construction, 2010.
2. ACI 301 – Specifications for Structural Concrete for Buildings, 2010.

D. Product Standards:

1. PS1 – Construction and Industrial Plywood.

1.4 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittal Procedures".

B. Product data for form release agent used with each type of form facing material.

C. Layout drawing showing location and detail of construction and control joints not indicated on Contract Documents. Indicate waterstops where occur.

D. Formwork removal and reshoring plan: For two-way slab construction, submit proposed plan for formwork removal, including sequence and methods of backshoring and reshoring.

E. Samples: Only as requested by Owner's Representative.

1.5 QUALITY ASSURANCE

A. Referenced Standard: Comply with provisions of ACI 301, except where more stringent requirements are shown or specified in this Section.

B. Mockups: Provide formwork as necessary for mockups and test panels.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. General: Comply with ACI 301, Section 2.

B. Plywood Form-facing Material: PS1, exterior-type plywood manufactured for concrete forming; edge sealed. Acceptable products: Type B-B Plyform, MDO-Concrete Form, or HDO-Concrete Form.

1. Provide only HDO-Concrete Form where surface finish SF-3.0 is specified, except as approved by Owners Representative.

C. Chamfer and Rustication Strips: Softwood strips, fabricated to produce uniform smooth lines. Strips shall not be ripped from plywood or other engineered wood products. At exposed conditions, provide in longest lengths practical.

D. Form Release Agents: Commercial formulation compounds, that will not bond with or stain concrete surfaces and will not impair bonding of paint or other coatings intended for use.

1. Use compounds specifically formulated for use on overlay plywood, where surfaces remain exposed to view in completed construction.

E. Form ties: Snap off metal ties of fixed length with plastic cone, designed to prevent spalling of concrete upon removal. Provide units that will leave no metal within 1-inch of concrete surface, except as otherwise designated.

1. Factory-fabricated, tapered removable ties for forming, will be acceptable at Contractor’s option.

F. Leave-in-place Stakes: Leave-in-place solid PVC or HDPE stakes, intended to serve as a permanent plug in vapor barrier, as necessary for screed stakes and to support formwork for slab on ground construction over vapor retarder. VaporStake by VaporStake, LLC, or approved equal.

G. EPS Foam for Forming: Provide load-bearing foam, except as otherwise designated or approved by Owner's Representative.

H. Load-Bearing: ASTM C578, Type XIV (40 psi) expanded polystyrene foam (EPS), or extruded polystyrene foam (EPSX) with equal compressive strength and stiffness. Acceptable products: Insulfoam XIV by Insulfoam, or approved equal.

I. Void Form: ASTM C578; Type IX (25 psi) expanded polystyrene foam (EPS). Material is intended for use where foam serves only as void form for concrete placement and is not required for support of load in completed work. Acceptable products: Insulfoam IX by Insulfoam, or approved equal.

J. Refer to "Leave-in-Place Formwork" for EPS for void forms that are not required to support load in completed construction.

K. Expansion Joint Filler:

1. Fiber-Type: Preformed asphalt impregnated fiber, ASTM D1751, 3/4 inch thick where not otherwise designated.
2. Foam-Type: Closed cell foam. ASTM D5249, Type 2, and ASTM D1752, Sections 5.1 to 5.4 at 10% minimum to 25% maximum compression, 3/4 inch thick where not otherwise designated.

L. Expansion Joint Sealant: Conform to Division 07 Section "Joint Sealants". Sealant used at floors shall be traffic grade, except where joint abuts a wall, column or other vertical surface.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF FORMWORK

A. Provide, erect, support, brace and maintain formwork and shoring to safely support loads caused by concrete placement and other loads that might be applied, until such loads can be supported by hardened concrete in the completed structure.

1. Contractor is responsible for design and engineering of formwork, including shoring and reshoring.

B. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, level and plumb work in finished structure. Finished work shall conform to tolerances of ACI 117, including tolerances of offsets at panel edges specified below.

1. Surface tolerance for finish SF-1.0 is Class D.
2. Surface tolerance for finish SF-2.0 is Class B, unless otherwise indicated.

3. Surface tolerance for finish SF-2.0 is Class C, where SF-2.0 finish surface is not exposed to view in completed construction (pits, surfaces to receive waterproofing, etc.).
4. Surface tolerance for finish SF-3.0 is Class A.

C. Select form facing materials to obtain required finishes. Solidly butt and back joints to prevent leakage of cement paste.

1. Provide plywood form-facing for finish SF-2.0, except as otherwise approved by Owners Representative.
2. Provide HDO overlay plywood form-facing for finish SF-3.0, except as otherwise approved by Owners Representative.

D. Provide shores and struts with positive means of vertical adjustment. Adjust forms to line prior to concrete placement and only as necessary during concrete placement; do not make adjustments following initial set of concrete.

1. To maintain specified elevation tolerances, camber formwork to compensate for anticipated deflections during concrete placement, including deflection of lower level floors that support shoring.

E. Make provisions in formwork for removal of debris from formed spaces. Locate temporary openings in inconspicuous locations at bottom of forms. Close ports with tight fitting panels, flush with inside face of forms.

F. Chamfer external corners of beams, columns and walls. Provide 3/4-inch chamfer where not otherwise designated.

G. Plywood Forms at Exposed-to-view Surfaces:

1. Keep number of panel joints to practical minimum.
2. Ensure vertical joints are plumb and horizontal joints are level.
3. Align form ties vertically and horizontally.

H. Form Release Agent: Apply a coating of form release agent immediately prior to installation of reinforcing steel and embedded items. Do not allow release agent to puddle on forms or concrete.

I. Provision for Other Trades: Provide openings in formwork and sleeves to accommodate work of other trades. Determine size and location of openings and recesses from trades requiring them. Obtain approval of Owner's Representative for openings not shown on structural drawings.

J. Earth Forms: Footing forms may be omitted and foundation concrete may be placed directly into neatly and accurately cut excavations, provided the excavation walls are stable.

1. Earth forms are constructed under Division 31 Section “Structural Excavation and Fill”.
2. Form footings to minimum extent shown on Drawings, but not less than 6 inches below finish grade at surfaces exposed to view. Leave-in place formwork shall not be acceptable in this zone.

K. Slab on Grade over Vapor Retarder: Avoid use of stakes through vapor retarder. Stakes will not be permitted where vapor barrier cannot be repaired after removal of stake.

1. Plastic stakes specifically designed for leave-in-place use by vapor retarder manufacturer will be permitted.

3.2 JOINTS

A. Expansion Joints:

1. Provide expansion joints and isolation joints where designated on Contract Documents.
2. Place joint filler in straight line with edge held back to specified dimension from finish surface and secured to formwork or previously placed construction.
3. Use fiber filler at building exterior, except where joints are to be sealed.
4. Use foam type joint filler at all interior joints and at sealed joints at building exterior. Hold edge back as required for sealant application in accordance with sealant manufacturer's recommendations.

B. Construction Joints:

1. Provide where shown on drawings or as approved by the Owner's Representative.
2. Provide 1-1/2 inch deep key indentations at formed joints in beams, walls, and slabs that are 8 inches or more in thickness. Make key 1/3 of member thickness at widest portion of kerfed form.
3. Provide rustication strips at exposed to view surfaces. Where no reveal remains in completed construction, install 3/4 inch x 1-1/2 inch kerfed strip centered on joint and remove strip prior to making second pour.

3.3 EMBEDDED ITEMS

A. Accurately place and securely support anchorage devices and other embedded items required for other work that is attached to cast in place concrete.

1. Use setting templates, drawings, and instructions provided by supplier of items.
2. Temporarily fill voids with readily removable material to prevent entry of concrete.
3. Use only stainless steel fasteners for securing built in items to formwork, where end of fastener is exposed to view or weather in completed construction. Cut back and grind fasteners flush with concrete surface.

B. Anchor rods (bolts) for steel columns shall be set to tolerances of Section 7.5.1 of AISC "Code of Standard Practice" (2010), which are more stringent than the requirements of ACI 117.

C. Aluminum Items: Aluminum surfaces in contact with concrete shall be painted with a bituminous paint complying with SSPC Paint 12, “Cold Applied Asphaltic Mastic”, 1/8-inch minimum thickness; or other approved coating system.

3.4 FORM REMOVAL

A. Do not remove forms and shores until concrete has hardened and attained sufficient strength to permit safe removal and adequate support of inherent and imposed loads.

1. In multi-story buildings, provide reshoring, as necessary, to distribute weight of newly placed concrete and construction live loads over sufficient number of floors below. Sequence form removal, shoring and reshoring in accordance with submitted formwork removal and reshoring plan.

B. Carefully remove form facing material to avoid spalling concrete surfaces, in particular at corners and edges of exposed to view concrete. Prying against the face of concrete shall not be allowed.

C. Where form facing material is removed in less than 3 days, immediately commence curing in accordance with provisions of Section 033000, "Cast-in-Place Concrete".

D. Beams and One-way Slabs: Maintain forms and shores at underside until concrete achieves 75% of design strength, minimum 7 days. Maintain shores or backshores until concrete has achieved design strength, 21 days minimum. Install reshores, as necessary, where placement continues above.

E. Two-way Slabs: Conform to submitted formwork removal and reshoring plan.

1. Maintain forms and shores until concrete achieves 75% of design strength, minimum 7 days.

a. Form facing material and horizontal supports may be removed after 3 days where formwork system allows shores to remain in place undisturbed by removal of formwork.

2. Maintain shores until concrete achieves design strength, minimum 21 days.

a. Shores may be removed after concrete achieves 75% of design strength, minimum 7 days, when replaced by a system of preshores and backshores that prevent slab deflection.
b. Maintain backshores until concrete achieves design compressive strength, 21 days minimum.
c. For post-tensioned slab construction, shores may be removed following tensioning operation.

3. Where placement continues at additional levels above, provide a system of reshores. One level of shoring or backshoring and minimum 2 additional levels of reshoring shall be maintained until concrete achieves design strength, 21 days minimum.

a. For post-tensioned slab construction, reshoring may be removed following tensioning operation.

3.5 REUSE OF FORMS

A. Reuse of forms shall be acceptable provided they are straight, clean, free from nails, dirt, hardened concrete, rust, and other injurious matter and edges and surfaces are in good condition. Reuse of formwork that would reduce quality of exposed-to-view concrete shall not be permitted.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Reinforcement for cast-in-place concrete and shotcrete.
2. Accessories as required to support and secure reinforcement.
3. Stud-rails for slab reinforcement.

B. Related Sections:

1. Section 036100 – Grouted Dowels for installation of reinforcing bar dowels in hardened concrete.
2. Section 051200 – Structural Steel Framing for reinforcement welded to structural steel.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 318, Section 3.8, "Referenced standards”.

C. American Concrete Institute's:

1. ACI 301 – Specifications for Structural Concrete for Buildings, 2010.
2. ACI 315 – Details and Detailing of Concrete Reinforcing.
3. ACI 318 – Building Code Requirements for Structural Concrete, 2011.

D. American Welding Society:

1. AWS D1.4 – Structural Welding Code - Reinforcing Steel, 2011.

E. CBC – 2013 California Building Code, including amendments applicable to OSHPD1 regulated facilities.

F. Concrete Reinforcing Steel Institute's:

1. CRSI Manual – "Manual of Standard Practice", 28th Edition.

G. IAPMO Evaluation Service (IAPMO-ES):

1. IAPMO-ES "Evaluation Reports" and "Acceptance Criteria" indicating compliance of proprietary products for conformance with 2012 International Building Code.

H. ICC Evaluation Service (ICC-ES):

1. ICC-ES "Evaluation Reports" and "Acceptance Criteria" indicating compliance of proprietary products for conformance with 2012 International Building Code.

1.4 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittal Procedures".

B. Test Reports: Furnish test reports, evidencing and certifying compliance with specified standards, to Testing Laboratory for record purposes.

1. Reinforcing steel.
2. Shear studs and stud-rail assemblies.

C. Product data for proprietary items, including bar couplers, headed bars, stud-rails, and welding electrodes.

1. Furnish manufacturer's written installation instructions and Evaluation Reports indicating quality control and special inspection requirements to Testing Laboratory for their use.

D. Welding Qualifications:

1. Welding procedure specifications (WPS) and procedure qualification records (PQR).
2. Submit welder qualifications to Testing Laboratory for record purposes.

E. Shop Drawings: Submit placing drawings prepared in accordance with ACI 315. Show size, shape and location of bars in structure. Show splice locations and lengths. Where details are not shown on Contract Documents, conform to standards of practice indicated in ACI 315.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of ACI 301 and CRSI's "Manual of Standard Practice", except where more stringent requirements are shown or specified.

B. Material Quality Assurance:

1. Reinforcing: Mill test reports including chemical analysis, tensile properties and bend test shall be examined for all reinforcing. Conform to one of the following:

a. Maintain positive identification of reinforcing by heat number. Provide certified mill test reports to Testing Laboratory.
b. Where positive identification cannot be made and procedures are not deemed adequate to ensure compliance, Owner's Testing Laboratory will randomly sample and make one tensile and one bend test from each 2½ tons or fraction thereof of each size of reinforcement. Contractor will bear the cost of testing.

2. Headed Deformed Bars:

a. Conform to quality assurance requirements of applicable ICC-ES or IAPMO-ES Evaluation Report.
b. At the start of fabrication, tension test 2 headed bar specimens for each bar size used in the work. Testing may be conducted by manufacturer's laboratory, subject to approval of Owner's Representative. Fabricator shall bear the cost of testing.
c. When number of headed bars of one size exceeds 200, tension test 1 additional specimen for each additional 200 heads or fraction thereof.

3. Mechanical Bar Couplers:

a. Conform to quality assurance requirements of applicable ICC-ES or IAPMO-ES Evaluation Report.

C. Qualifications for Welding Work: Qualify welding procedures and welders in accordance with AWS D1.4.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store reinforcement in a manner that will prevent excessive rusting or fouling with grease, oil, dirt, and other bond weakening materials.

B. Store in a manner to maintain identification of bars after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bar Reinforcement: ASTM A615, Grade 60, or ASTM A706 deformed bars, except as otherwise designated.

1. ASTM A706 for bars to be welded.
2. ASTM A615, Grade 75, where designated on Contract Documents.

B. Headed Bar Reinforcement: Deformed bar reinforcement (#11 and smaller) with forged, welded, or mechanically attached heads conforming to the requirements of ASTM A970, including Annex A1 Requirements for Class HA Head Dimensions. Acceptable systems shall have an active ICC-ES or IAPMO-ES Evaluation Report evidencing compliance with specified criteria and establishing quality assurance and special inspection requirements. Subject to compliance with requirements, provide one of the following, or approved equal:

1. HRC 555 Headed Bar, by Headed Reinforcement Corp. (ICC ESR-2935).
2. Bartech Mechanical Anchor, by Dextra Manufacturing Co. (ICC ESR-2166).
3. Lenton Terminator D16 (taper threaded); by Erico (IAPMO ESR-0129).

C. Welded Wire Fabric: ASTM A1064.

D. Smooth Dowels: ASTM A615, Grade 40 or 60, smooth; sawcut or grind ends to remove offsets; shop paint with iron-oxide zinc-chromate primer with 2.0 mils dry film thickness or provide epoxy coated.

E. Galvanized Reinforcing Bars: ASTM A767 hot-dip galvanized deformed bar reinforcement.

F. Stainless Steel Reinforcing bars: ASTM A955, Grade 60, deformed.

G. Bar Couplers: Capable of producing Type 1 or Type 2 mechanical splice in accordance with Section 21.1.6 of ACI 318. Select coupler type considering conditions of installation and space limitations; maintain specified cover and reinforcement position acceptable to Owner's Representative. Acceptable coupler systems shall have an active ICC-ES or IAPMO-ES Evaluation Report evidencing compliance with the specified criteria and establishing quality assurance and special inspection requirements.

1. Type 1 splices shall be acceptable, unless otherwise designated.
2. Where spliced bars are designated to conform to ASTM A706 or where splices are designated as Type 2 on drawings, splices shall conform to Type 2.
3. Subject to compliance with requirements, provide one of the following mechanical splice systems:

    a. Lenton, Erico Inc. (IAPMO ESR-0129)
    b. Bartec, Dextra America, Inc. (ICC ESR-1705)
    c. Taperlock, Dayton Superior (ICC ESR-2481)
    d. HRC 500/510, Headed Reinforcement Corp (ICC ESR-2764)
    e. Bar-Lock, Dayton Superior (ICC ESR-2495)

H. Stud-rails: Welded assemblies of specialty headed shear studs and base rails conforming to ASTM A1044. Acceptable stud-rail systems shall have an active ICC-ES or IAPMO-ES Evaluation Report evidencing compliance with the specified criteria and establishing quality assurance and special inspection requirements.

I. Welding Electrodes: AWS D1.4.

J. Bar Supports: Conform to requirements of CRSI Manual.

1. Provide precast concrete supports, with base not less than 3 inches square, against ground or atop vapor retarder.
2. Provide CRSI Class 1 plastic or plastic protected supports at surfaces exposed to view or weather in completed construction. Select support type to provide minimum surface contact.
3. CRSI Class 2 wire supports and precast concrete supports shall be acceptable at surfaces not exposed to view in completed construction.
4. CRSI Class 3 wire supports shall be acceptable where support is no closer than 1/2 inch to surface or where support is placed atop steel deck.
5. Supports and tie wire for epoxy coated bars shall be plastic or polymer coated, and shall be of configuration approved by Owner's Representative.

2.2 FABRICATION

A. Shop fabricate reinforcement to standard fabrication tolerances indicated in ACI 315.

B. Column Bar Splices: Offset bend bars at 1:6 slope at splices, except at round columns that permit bars to be in the same circle.

C. Spirals:

1. End Anchorage: Provide 1½ extra turns with 90-degree tie hook at each end of spiral unit.
2. Splices: Provide designated lap splice and 90-deg tie hook at end of each spiral unit; no additional turns are required. Lap splice shall be minimum 48 bar diameters for deformed bars and 72 wire diameters for smooth wire.

D. Headed Bars: Headed deformed bars will be allowed to be substituted for 90 deg hooked bars, subject to meeting the requirements specified herein and written approval of Owner's Representative.

1. Bars are designated to be ASTM A615, Grade 60 or ASTM A706.
2. Clearance between headed bars shall be at least 4 bar diameters in accordance with ACI 318, Section 12.6.
3. A minimum cover of 2 bar diameters, 1½ inches minimum, shall be provided to all faces of head.
4. Headed bars shall not be substituted for stirrups and ties that serve to confine beam and column reinforcing.
5. No additional cost to Owner.
6. Contractor shall pay the cost of any additional testing and inspection associated with use of headed bars.

E. Cage Preassembly: Pre-assembled of beam cages by machine fusion welding of holding wires to stirrups shall be acceptable, subject to the requirements below. Welding of holding wires to ties at columns and boundary elements for shear walls shall not be permitted.

1. Stirrup bars shall conform to ASTM A706.
2. Holding wires shall conform to ASTM A82 or A496.
3. Welding shall be performed by machine under a continuous controlled process.

4. Quality control tests shall be performed on shop-welded specimens at no cost to Owner. A minimum of 3 specimens shall be sampled from the work of the project and tension tested. Tests will be acceptable if the specified minimum tension strength and the required elongation for ASTM A615, Grade 60 reinforcement is achieved. Sampling and testing shall be performed or witnessed by the Owner's Testing Laboratory.

2.3 SOURCE QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality Requirements".

B. Testing Laboratory will:

1. Review Quality Assurance procedures for maintaining identification of steel.
2. Make one tensile and one bend test from each 10 tons or fraction thereof of each size of reinforcing steel in accordance with CBC Section 1916A.2.
3. Review Quality Assurance procedures for fabrication of proprietary items, including headed bars, couplers, stud-rails. Perform special inspection as required by applicable Evaluation Report.
4. Review equipment and Quality Assurance procedures for cage pre-assembly using welded holding wires. Perform or witness specified sampling and testing.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place and maintain bars at locations shown on Drawings to the tolerances of ACI 117, including but not limited to the following:

1. Clear distance to formed surfaces: Plus or minus 1/4 inch.
2. Top bars in slabs 8 inches deep or less: Plus or minus 1/4 inch.
3. Top bars in foundations, beams and slabs over 8 inches deep: Plus 1/2 inch and minus 1/2 inch.

B. Maintain minimum coverage as indicated for concrete protection. Conform to requirements of ACI 301 where not indicated.

1. Cover shall not be reduced at mechanical couplers and headed reinforcing.

C. Place reinforcement with 1-1/2 bar diameters minimum clear distance between bars, but not less than 1-1/2 inches. Where specified clearance cannot be achieved, bundle bars.

1. Conform to additional requirements for spacing of headed bars.

D. Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI "Manual" as a minimum standard.

E. Take precautions to protect vapor retarder beneath slab-on-ground from damage during installation of reinforcement.

F. Lap Splices:

1. Contact Splice: Lapped bars shall be placed in contact and securely tied. Lap shall be oriented to maintain bars in their designated layer, except where offset bent bars are used at splices. Stagger lap splices where necessary to maintain minimum 1 bar diameter and 1 inch clearance between bars at splice.
2. Noncontact Splice: Lapped bars shall be spaced apart a minimum of 1 bar diameter and 1 inch to permit the encasement of the entire surface of the bar in concrete. Bars shall not be spaced farther apart than one-fifth of the lap length and 6 inches maximum. Whenever practical, use noncontact splices, with 4 inch minimum clear spacing, for shotcrete construction.
3. Stagger splices of bundled bars so that splices do not overlap.
4. Welded Wire Fabric: Overlap outermost cross wires of each piece one wire space plus 2 inches. Wire or clip together at maximum 3-foot spacing. Stagger splices in one direction.

G. Mechanical Splices: Make splices in accordance with applicable Evaluation Report. Maintain specified concrete cover at couplers. Stagger mechanical splices as necessary to maintain clearances.

H. Welding:

1. Welding is not permitted unless specifically detailed on plans or approved by Owner's Representative.
2. Conform to requirements of AWS D1.4 using qualified procedures.
3. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
4. Do not tack weld crossing bars for assembly of reinforcement, supports, or embedded items.

I. Smooth Dowels: Install at locations shown and accurately positioned at right angles to joint being doweled. Dowels shall be rigidly supported during concrete placement and one end of dowel shall be coated with bond breaker.

J. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning; remove loose rust.

K. Field Straightening: Bar reinforcement shall not be field bent after being embedded in hardened concrete. Reinforcement that is accidentally bent, up to a 1:2 bend (30 deg) and not severely kinked, will be permitted to be straightened subject to the approval of the Owner's Representative. #7 and smaller bars may be straightened cold. Larger bars shall be preheated prior to bending in accordance with the provisions of ACI 301.

3.2 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality Requirements".

B. Testing Laboratory will:

1. Special Inspect placement of reinforcement for conformance with the Contract Documents, as required by CBC Table 1705A.3.
2. Special Inspect installation of mechanical couplers in accordance with requirements of applicable Evaluation Report.
3. Special Inspect welding as required by CBC Table 1705A.4, for compliance with AWS D1.4; including checking materials, equipment, procedure and welder qualification as well as the welds. Inspector will use nondestructive testing or any other aid to visual inspection that he deems necessary to assure the adequacy of the weld.
4. Observe the straightening of bent reinforcing. Where warranted by severity of bend, Inspector will pull test reinforcing to specified yield strength after straightening.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Cast-in-place concrete, unless otherwise noted.
2. Granular base and underslab vapor retarder assembly beneath building slab-on-ground.
3. Preparation of existing concrete surfaces to receive new concrete.
4. Construction joint waterstops.
5. Grout for baseplates and bearing plates.

B. Related Sections:

1. Section 031000 – Concrete Forming.
2. Section 032000 – Concrete Reinforcing.
3. Division 31 Sections for concrete for earthwork and pile foundations.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in ACI 301.

C. ACI: Standards of the American Concrete Institute (ACI) apply where designated in this section. Use applicable year of adoption or revision as published in ACI 301.

1. ACI 301 - Specifications for Structural Concrete for Buildings, 2010.
2. ACI 318 - Building Code Requirements for Structural Concrete, 2011.

D. CBC – 2013 California Building Code, including provisions applicable to OSHPD regulated facilities.

E. IAPMO Evaluation Service (IAPMO-ES):

1. IAPMO-ES "Evaluation Reports" and "Acceptance Criteria" indicating compliance of proprietary products for conformance with 2012 International Building Code.

F. ICC Evaluation Service (ICC-ES):

1. ICC-ES "Evaluation Reports" and "Acceptance Criteria" indicating compliance of proprietary products for conformance with 2012 International Building Code.

G. State of California, Department of Transportation (Caltrans):

1. Caltrans Standard Specifications, 2010.
2. California Test Methods (Available at www.dot.ca.gov/hq/esc/ctms/index.html).

1.4 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section, "Submittal Procedures".

B. Mix design for each concrete mixture, including:

1. Mixture proportions.

a. Note method of adjusting mix proportions to account for variation in unit weight of lightweight aggregates.

2. Mixture properties.

a. Include compressive strength, slump, entrained air, and fresh density.
b. For lightweight concrete, include equilibrium density (ASTM C567 quick method).

3. Mix designs shall be signed and sealed by a Professional Engineer, licensed in the State of California.

C. Laboratory test reports for concrete mixes.

1. Compression test data (field experience method) or results of testing (trial batch method) used to establish proportions for each mix.

a. Submit sufficient data to represent the range of materials intended for use in the work, in accordance with ACI 318, Section 5.3.3.

2. Alkali-silica reactivity test data where results of aggregate testing are other than innocuous.

D. Material certificates of compliance with specified standards.

1. Portland cement.
2. Supplementary cementitious materials, including fly ash and slag cement.

3. Aggregates, including gradation.

E. Product data for proprietary materials and items, including admixtures, synthetic fiber reinforcement, bonding agents, finish materials, curing materials, vapor retarder, waterstops, and nonshrink grout.

F. LEED Submittals: Report information necessary for LEED Certification. Refer to Section 018113 for requirements.

1. Product Data for Credit MR 5.1: For each material, including its source, cost, and the fraction by weight that is considered regional and that has been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
2. Product Data for Credit EQ 4.1: Product data and material safety data sheets (MSDS) for installation adhesives, paints, coatings applied on-site on the interior of the building and products used on the interior of the building including printed statement of chemical composition and VOC content of each product used.

G. Submit ticket to Owner's Testing Laboratory for each batch of concrete delivered, bearing the following information.

1. Mix identification.
2. Date and time of batching.
3. Types and weights of cementitious materials. Sources, sizes and weights of coarse and fine aggregates. Weight of water added at plant. Types and volume of liquid admixtures added at plant.
4. Volume of water and liquid admixtures added subsequent to initial batching. Time and place of addition.

H. Samples as requested by Testing Laboratory or Owner's Representative.

1.5 QUALITY ASSURANCE

A. Comply with applicable provisions of following codes and specifications, except where more stringent requirements are shown or specified.

1. ACI 301: Specifications for Structural Concrete for Buildings.
2. ACI 318: Building Code Requirements for Reinforced Concrete.

B. Concrete batch plant shall comply with the requirements of ASTM C94, Section 10, as certified by the National Ready Mixed Concrete Association.

C. Concrete Supplier's Testing Laboratory shall comply with the requirements of ASTM E329 and be under the direction of a professional engineer, licensed in the State of California.

D. If the test results of aggregates for potential reactivity (ASTM C289) are other than innocuous, concrete mixtures shall be tested in accordance with ASTM C1567. Tests shall indicate an expansion of less than 0.10 percent at 16 days age.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cementitious materials and aggregates shall have a proven history of successful use together, or submit evidence satisfactory to Owner's Representative that aggregate will not react harmfully in presence of alkalis in cement.

B. Cementitious materials and aggregates for concrete for exposed surfaces of like elements shall be from same source throughout the work.

C. Cementitious materials: Combination of Portland cement and supplementary cementitious materials; subject to limitations specified herein.

1. Portland cement: ASTM C150, Type I, II or V, low alkali.
2. Fly ash: ASTM C618, Class F; except the maximum loss on ignition shall not exceed 1.0%. More than 15% by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportional per ACI 318 Section 5.3. See Section 1904A for durability requirements.
3. Slag cement: ASTM C989, Grade 100 or 120. More than 40% by weight of ground-granulated blast-furnace slag shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportional per ACI 318 Section 5.3. See Section 1904A for durability requirements.

D. Coarse aggregates:

1. ASTM C33 and CBC 2013 Section 1903A.6.
2. Cleanness value shall not be less than 75 when tested in accordance with California Test 227, "Evaluating Cleanness of Coarse Aggregate".
3. Aggregate shall contain no thin or elongated pieces. The length of any piece shall not exceed 2½ times the average thickness.
4. Aggregate for Shrinkage Controlled Concrete shall be from one of the following sources, or approved equal: Orca (as supplied by Cemex), limestone (Hanson), granite (Granite Rock's Aromas), or Clayton (Hanson or Cemex).
5. Aggregate for lightweight concrete: ASTM C330, rotary kiln-expanded shale or clay having surface sealed by firing. 3/8 inch size. As manufactured by Trinity Expanded Concrete & Shale, or approved equal.

E. Fine Aggregates:

1. ASTM C33.
2. Sand equivalent shall not be less than 75 when tested in accordance with California Test 217, "Sand Equivalent".

F. Water: Combined water consisting of potable water and reclaimed water from mixer wash-out operations; subject to limitations specified herein.

1. Provide 100% potable water for Architectural Concrete, Shrinkage Controlled Concrete, post-tensioned concrete, and lightweight concrete.

2. Combined water for other uses may contain maximum 25% reclaimed water meeting requirements of ASTM C1602.

G. Admixtures: Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized. Acceptable Manufacturers: BASF Construction Chemicals, W.R. Grace and Co., or Euclid Chemical Co.

1. General: Admixtures containing more than 0.05% chloride ions are not permitted.
2. Air-entraining: ASTM C260. Where entrained air is not specified in Contract Documents, total air shall not exceed 3% by volume.
3. Water-reducing: ASTM C494, Type A.
4. Set-retarding: ASTM C494, Type B. Provide in necessary dosage to achieve desired set time.
5. Set-accelerating: ASTM C494, Type C, non-chloride. Provide in necessary dosage to achieve desired set time.
6. Mid-range water-reducing: ASTM C494, Type A/F, polycarboxylate formulation designed to minimize shrinkage. Provide in manufacturer's recommended (mid-range) dosage where specified, or where otherwise requested by Contractor to increase slump to facilitate pumping and/ or placement.
7. High-range water-reducing (superplasticizer): ASTM C494, Type F, polycarboxylate formulation designed to minimize segregation and shrinkage. Where specified, provide in manufacturer's recommended (high-range) dosage.
8. Viscosity-modifying (VMA): ASTM C494, Type S. Provide in manufacturer's recommended dosage to facilitate pumping, subject to approval of Owner's Representative.
9. Shrinkage-reducing (SRA): Acceptable products: Eclipse® Floor 200 by W.R. Grace, MasterLife® SRA 20 by BASF, or approved equal. Provide in dosage specified herein.

    a. Where floor is intended to be ground and polished, verify compatibility of admixture with hardener.

H. Waterproofing Admixture: Crystalline waterproofing admixture, designed to be added to concrete mix at time of batching. Acceptable products: Admix C–500 by Xypex Chemical Co., Penetron Admix, by ICS Penetron International Ltd., or approved equal.

I. Micro-synthetic fibers: Synthetic fibers, manufactured from 100 percent virgin homopolymer polypropylene resins, designed for use as secondary reinforcing for concrete. Shall conform to ASTM C1116 for Type III fiber reinforced concrete and the requirements of ICC-ES AC32, Section 3.1.1 (plastic shrinkage reinforcement). Acceptable products: MasterFiber F70 by BASF, Fibermesh® 300 by Propex, Grace Fibers by W.R. Grace, or approved equal.

1. Unless otherwise indicated, incorporate at a dosage rate of 1.5 pounds per cubic yard.

J. Macro-synthetic fibers: Synthetic fibers, manufactured from polypropylene/polyethelene resins, designed for use as shrinkage and temperature reinforcing for concrete. Shall conform to ASTM C1116 for Type III fiber reinforced concrete and the requirements of ICC-ES AC32, Sections 3.1.1 (plastic shrinkage reinforcement) and 3.1.2 (shrinkage and temperature reinforcing. Acceptable products: MasterFiber MAC 100 by BASF, Novomesh® 950 by Propex, STRUX® 90/40 by W.R. Grace, or approved equal.

1. Unless otherwise indicated, incorporate at a dosage rate of 5.0 pounds per cubic yard.

2.2 RELATED MATERIALS

A. Granular base: Broken stone or crushed or uncrushed gravel, angular, free of deleterious matter. Gradation conforming to the following: 100% passing the 3/4-inch sieve, less than 10% passing the No. 4 sieve, and less than 2% passing the No. 200 sieve.

B. Vapor retarder: ASTM E1745, Class A plastic sheeting, with a water vapor permeance less than 0.02 perms in accordance with ASTM E1745, Section 7. Minimum 15 mil film thickness. Acceptable products: Moistop Ultra 15 by Fortifiber Corporation, Stego Wrap 15 mil by Stego Industries, or approved equal.

1. Provide manufacturer's recommended tape, mastic and boots for sealing of edges, seams, and penetrations.

C. Waterstop: Sodium bentonite and butyl rubber compound formed into strips. Compound shall expand to seal and fill voids in construction joints to prevent water infiltration under continuous immersion and wet/dry cycling.

1. Typical: 1-1/4" x 1/2" trapezoidal strip reinforced with a poly scrim. Use at construction joints in concrete sections thicker than 8 inches with two layers of reinforcing steel. Acceptable products: Waterstop RX 101T by CETCO, Swellstop No. 594 by Greenstreak, or approved equal.
2. Thin Section: 3/4" x 3/8" half circle. Use at construction joints in concrete sections less than 8 inches thick or with a single layer of reinforcing steel. Acceptable products: Waterstop RX 102 by CETCO, Swellstop No. 596 by Greenstreak, or approved equal.
3. Adhesive: As recommended by waterstop manufacturer. Acceptable products: CETSEAL by CETCO, Swellstop primer adhesive by Greenstreak, or approved equal.

D. Evaporation reducer: Monomolecular film-forming compound to prevent rapid drying of fresh concrete. Subject to compliance with requirements provide one of the following, or equal.

1. Eucobar, by Euclid Chemical, Co.
2. Confilm, by Master Builders, Inc.

E. Moisture-retaining cover (for curing):

1. Waterproof Paper: Asphalt laminated, reinforced wet strength kraft paper; conforming to ASTM C171. Acceptable Products: Orange Label Sisalkraft® by Fortifiber, or equal.
2. Laminated Polyethylene Burlap: 4 mil white opaque polyethylene laminated to 10 oz. burlap or nonwoven polypropelene fabric; conforming to ASTM C171, Type 1.1.3. Acceptable products: Curlap by Midwest Canvas Corp, Transguard 4000 by Raven Industries, or equal.

F. Curing compounds:

1. Type CC-1: Dissipating resin curing compound conforming to ASTM C309, Type 1, Class B, with a VOC less than 100 g/L. Acceptable products: 1100-Clear by WR Meadows, Kurez DR-100 by Euclid Chemical Co., or approved equal.
2. Type CC-2: ASTM C1315, Type 1, Class A, curing and sealing compound. Minimum 30% solids, water-based, non-yellowing acrylic copolymer, with a VOC less than 100g/L. Acceptable products: VOCOMP®-30, by WR Meadows (no known equal), or approved equal.
3. Type CC-3: Water-based, reactive penetrant specifically formulated for concrete curing. Shall meet or exceed the water retention requirements of ASTM C1315 (0.40 kg/m2 in 72 hours). Shall leave no surface residue and be compatible with patching compounds, paints and other wall coatings. Acceptable products: WCE Concrete Cure, by Sinak (no known equal), or equal.
4. Type CC-4: Compound for vapor emission control that also serves as a curing compound. Shall meet or exceed the water retention requirements of ASTM C309 (0.55 kg/m^2 in 72 hours). Refer to Division 07 Section Vapor Emission and Alkalinity Control for New Concrete" for requirements and acceptable products.

G. Floor leveling compound: High strength, Portland cement-based, nonshrink, self-leveling product designed specifically for leveling of concrete floors to receive adhered floor coverings. Compound shall install in thickness from featheredge to 1 inch in a single application. Minimum 4,000 psi compressive strength. Acceptable products: Ardex K 15® Self Leveling Underlayment Concrete, Mapei Ultraplan 1 Plus by Mapei International, or approved equal.

1. Primer: Product of underlayment manufacturer recommended for substrate conditions.
2. Aggregate: Where thickness exceeds 1-inch, add well-graded, washed aggregate, of gradation and amount as recommended by underlayment manufacturer.

H. Nonshrink grout: Premixed, nonmetallic, noncorrosive product, conforming to ASTM C1107. Minimum usable working time of 30 minutes at flowable consistency over temperature range of 50 deg F to 85 deg F. Acceptable products: Masterflow® 555 by BASF, Five Star® Grout by Five Star Products, Inc., or approved equal.

2.3 MIXES

A. Lean concrete: Not used. Refer to Section 312300, "Structural Excavation and Fill", for controlled low strength material (CLSM).

B. Mix “B”: For slab-on-ground, normal-weight fill over steel deck, formed slabs and beams, curbs and equipment pads, stair pan fills.

1. Compressive strength: 4,000 psi at 28 days (ASTM C39).
2. Slump: 6 inches, plus or minus 1-inch tolerance (ASTM C143).
3. Cementitious material: Total cementitious material shall not be less than 550 lbs per cubic yard.
4. Aggregate: Size 67 (3/4-inch) coarse aggregate.

    a. Coarse aggregate shall be from specified source for Shrinkage Controlled Concrete. Do not blend pea gravel with shrinkage controlled aggregates.

5. Admixtures: Mid-range, water-reducing admixture at necessary dosage to provide adequate slump and workability at specified water content.
6. Limit total water to 275 lbs maximum.
7. Limit water-to-cementitious material ratio to 0.45 by weight.

C. Mix "E": For lightweight structural concrete fill over steel deck.

1. Compressive strength: 4,000 psi at 28 days (ASTM C39).
2. Slump: 4 inches, plus or minus 1-inch tolerance (ASTM C143), measured at point of placement. Slump, measured at truck, shall not exceed 7 inches and slump loss due to pumping shall not exceed 2 inches.
3. Equilibrium density: 113 lbs per cu ft, plus or minus 3 pcf (ASTM C567, quick method). Fresh density, measured at truck, shall not exceed 125 lbs per cu ft. (ASTM C138).
4. Air: 5.5%, plus or minus 1.5% tolerance, air by volume at point of placement (ASTM C173 - Volumetric Method).
5. Cementitious material: 85% Portland cement and 15% fly ash, except as otherwise approved by Owner’s Representative. Total cementitious material shall not be less than 600 lbs per cubic yard.
6. Aggregate: Mix shall contain a minimum of 1000 pounds of fully presaturated lightweight coarse aggregate per cubic yard (based on use of Trinity’s Frazier Park expanded clay aggregate).
7. Admixtures:

    a. ASTM C494, Type A/F mid-range, water-reducing admixture at manufacturer's recommended mid-range dosage.
    b. Provide VMA at manufacturer’s recommended dosage where required to facilitate pumping.

D. Watertight concrete: For sumps, pits and where otherwise designated.

1. Same as Mix "B", except as otherwise noted.
2. Admixtures: Add crystalline waterproofing admixture at manufacturer's recommended dosage rate.

E. Patching mortar: One part Portland cement to two parts sand. At exposed surfaces, substitute white cement as necessary to match color of surrounding concrete.

1. Intended for use for patching of form ties and bug holes. Not suitable for repair of large defects; provide pre-packaged repair mortar suitable for size and shape of defect and approved by Owner's Representative.

2.4 PROPORTIONING

A. Contractor shall determine the mix proportions for concrete in conformance with these specifications.

B. Proportion mixes in accordance with ACI 318, on the basis of field experience or trial batches.

1. When trial batch method is used, trial batches shall be proportioned by Contractor's Design Laboratory that conforms to specified quality assurance requirements.
2. Conform to additional requirements of ACI 211.2 for lightweight concrete.

C. Proposed mixes shall produce concrete to strengths specified with adequate workability and proper consistency to permit concrete to be conveyed by pumping and worked into forms and around reinforcement without excessive segregation or bleeding.

D. The total chloride ion content, calculated on the basis of mix proportions, shall not exceed the limits specified in ACI 318 Table 4.4.1. The total chloride ion content shall not be allowed to exceed 0.30% for any use.

E. Mix design adjustments may be requested by Contractor when job conditions or test results warrant. Revised mix design must be submitted to and accepted by Owner's Representative before using in work.

1. Approved set-accelerating and set-retarding admixtures may be used to control set times when warranted by weather conditions, without resubmittal of mixes.
2. Batching weight of lightweight aggregates shall be adjusted to maintain a constant volume of aggregate, without resubmittal of mixes.

2.5 CONCRETE MEASUREMENTS AND MIXING

A. Materials for concrete shall be measured by weighing the aggregates and cement using equipment that is suitable, designed and constructed for this purpose. Each size of aggregate and the cement shall be weighed separately. The accuracy of all measuring devices shall be such that quantities be measured to within the following percentages of the desired amount: 1% for cement and water, 2% for aggregates, and 3% for admixtures. Mixing water and all admixtures shall be measured by volume.

B. All concrete shall be machine mixed in accordance with ACI 318, Section 5.8. Deposit concrete into final position within 90 minutes of introduction of cement.

1. Mixing time shall be reduced in hot weather in accordance with Hot Weather Concreting provisions of this Section.

2. Mixing time shall be increased to accommodate project conditions, only with prior written approval of Owner's Representative and subject to use of set retarders, control of revolutions of mixing drum and monitoring of concrete temperature.

C. After initial batching, additions shall be limited to water, high range water reducers and non-chloride accelerators, subject to the following:

1. Additions shall be made only in the presence of Testing Laboratory, using suitable calibrated devices.
2. Water additions shall not exceed water-to-cementitious ratio requirements.
3. Following addition of HRWR or accelerator admixtures, complete a minimum of 70 revolutions or 5 minutes of mixing to assure a consistent mixture.

2.6 SOURCE QUALITY CONTROL

A. Batch Plant Inspection:

1. An approved special inspector from the Owner's Testing Laboratory shall review mix proportions with the licensed weighmaster at the start of each day's placement and observe the first batching.
2. Licensed weighmaster to positively identify materials as to quantity and certify to each load by ticket.
3. Tickets shall be transmitted to the inspector of record by a truck driver with load identified thereon. The inspector will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to the enforcement agency.
4. At the end of the project, weighmaster shall furnish an affidavit to the enforcement agency certifying that concrete furnished conforms in every particular to proportions established by mix designs.

PART 3 - EXECUTION

3.1 CONSTRUCTION JOINT PREPARATION

A. Horizontal joints: Remove entire surface to expose clean aggregate solidly embedded in mortar matrix to full 1/4-inch amplitude. Do not leave laitance, loosened particles of aggregate or debris at surface.

1. At Contractor's option, use chemical surface retarder as an aid to joint preparation.

B. Vertical joints: Remove formwork and coatings to expose clean and sound concrete. Joints that are formed and keyed in accordance with drawings need not be intentionally roughened.

C. Waterstops: Provide at construction joints in below grade pits and where indicated on Drawings. Install waterstops in accordance with manufacturer's written instructions, using adhesive. Tightly butt ends of adjoining sections; do not overlap. Protect waterstop from wetting prior to concrete placement; replace waterstop that has partially hydrated.

1. Place typical waterstop with 3 inches minimum cover to concrete surface exposed to water, and between layers of reinforcing.
2. At thin sections, place waterstop with 2 inches minimum cover nearest to face of concrete exposed to water.

3.2 PREPARATION FOR SLAB-ON-GROUND CONSTRUCTION

A. Place granular base to thickness specified on Drawings. Consolidate and smooth surface with a vibratory plate.

B. Place underslab vapor retarder in accordance with recommendations of ASTM E1643 with longest dimension parallel with direction of pour, lapping seams 6 inches and sealing with manufacturer’s recommended adhesive or pressure sensitive tape.

1. Seal around penetrations through vapor retarder, such as utilities, to create a monolithic membrane between the surface of the slab and the subgrade. Repair damaged vapor retarder prior to placement of concrete.
2. Where vapor retarder is interrupted at interior or edge footings, lap vapor retarder 2 inches minimum over footing.

C. Repair vapor retarder damaged during placement of reinforcement or concrete with patch of vapor retarder material. Lap beyond edges of damaged area a minimum of 6 inches and seal edges as prescribed for seams.

D. Do not place concrete until Owner's Representative has observed vapor retarder and damaged areas have been repaired.

3.3 PLACING

A. Examine units of work to be cast and verify that:

1. Construction of formwork is complete.
2. Required reinforcement, inserts, and embedded items are in place and securely held.
3. Concrete-receiving places are free of debris and excess water.

B. Protect finished surfaces adjacent to concrete-receiving places.

C. Notify Owner's Representative at least 24 hours before placing concrete.

D. Placing Record: Record time and date of casting concrete in units of building; maintain record open to inspection by the Owner's Representative.

E. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent segregation.

F. Pump conveyance of lightweight concrete: Use equipment and procedures demonstrated as satisfactory to minimize slump loss, including but not limited to the following:

1. All line shall be 4 inches minimum diameter.
2. Limit the use of rubber line to 100 feet maximum, except with acceptance of Owner's Representative.

G. Cold weather placement: When concrete is likely to be subjected to freezing temperatures within 24 hours or when placing concrete at air temperatures less than 40 deg F, the temperature of the concrete at the point of placement shall be at least 55 deg F for sections thinner than 12 inches and 50 deg F for sections thicker than 12 inches. Do not exceed this temperature by more than 20 deg F. Use only approved accelerating admixtures.

H. Hot weather placement: When air temperature exceeds 80 deg F, take special precautions to prevent slump loss, rapid setting, and plastic shrinkage; including but not limited to:

1. Cool ingredients before mixing to maintain concrete temperature at point of placement below 90 deg F.
2. Convey and deposit concrete as rapidly as practicable, such that concrete temperature does not exceed 90 deg F at point of placement.
3. Apply evaporation reducer immediately after screeding.

I. Placing concrete in forms:

1. In depositing concrete in columns or walls, place concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or metal reinforcement above the level of the concrete.
2. Deposit concrete in horizontal layers and in a manner to avoid inclined joints. Place each layer while preceding layer is still plastic to avoid cold joints.
3. Keep forms and reinforcement clean above pour line.
4. Do not use vibrators to transport concrete in forms.

J. Consolidating:

1. Use internal vibrators for thorough consolidation of all concrete.
2. Use size and power recommended by ACI 309 for the element of work.
3. Use consolidation techniques that minimize entrapped air; refer to ACI 309.
4. Do not place vibrators against reinforcement or forms.

K. Construction joints shall conform to typical details and be located where shown on Drawings or approved by the Owner's Representative. Horizontal joints in walls and columns shall be at the underside of slabs. Place beams, girders, brackets, column capitals, haunches, and drop panels at the same time as the slabs.

L. Floor slabs on steel framing:

1. Deposit concrete working outward from beam centers to avoid overloading steel deck.
2. Maintain specified concrete thickness over steel deck as a minimum. Increase thickness as required to compensate for deflection of steel deck.

3.4 FINISHING FOR NON-FORMED SURFACES

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces.

B. Finish Schedule: Refer to Article 3.12, "Finish Schedule" for finish types and locations. Refer to Division 03 Section “Concrete Finishing” for specialty finishes of exposed to view concrete.

C. Flatness/ levelness tolerances: Measure floors for flatness (SOF_F) and levelness (SOF_L) according to the method of ASTM E1155, within 72 hours after slab finishing. Floors shall conform to tolerances of ACI 117 listed in Finish Schedule.

1. Exception: Tolerance for levelness does not apply to floors supported by steel framing; measure floor levelness for information only.
2. Corrective action: Failure to achieve the specified tolerances will require remedial action, including grinding and/or application of leveling materials. The cost of remedial action will be borne by the Contractor.

D. Slab Finishes:

1. Scratch Finish: Place, consolidate, strike off, and level concrete. Roughen surface with stiff brooms or rakes prior to final set.
2. Float Finish: Place, consolidate, strike off and level concrete. Do not work further until concrete is ready for floating. Consolidate surface with a bladed power float with float shoes or a powered disk float, or by hand floating if area is small or inaccessible to power driven floats. Repeat float passes until surface conforms to specified tolerances and is left with a uniform, smooth, granular texture.
3. Trowel Finish: After applying float finish, power-trowel the surface. Continue troweling passes until surface is planed to the specified tolerance and uniform in texture. Do not burnish floors intended to receive floor coverings. Hand trowel the surface smooth and free of trowel marks.
4. Broom Finish: After applying float finish roughen surface by drawing a fiber bristle broom, not less than 24 inches wide, across surface perpendicular to main traffic route. Produce even texture from edge to edge, lapping adjacent strokes slightly to produce uniform pattern.

    a. Obtain Owner's Representative’s approval for texture of final finish before application.

3.5 FINISHES FOR FORMED SURFACES

A. General: Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.

B. Surface Finish – 1.0 (Rough Formed):

1. No formwork facing material is specified.
2. Patch voids larger than 1½ in. wide or 1/2 in. deep.
3. Remove projections larger than 1 in.
4. Tie holes need not be patched.
5. Surface tolerance Class D as specified in ACI 117.

C. Surface Finish – 2.0 (Smooth-formed):

1. Plywood formwork facing.
2. Patch voids larger than 3/4 in. wide or 1/2 in. deep.
3. Remove projections larger than 1/4 in.
4. Patch tie holes.
5. Surface tolerance Class B as specified in ACI 117; except Class C shall be acceptable where finish surface is not exposed (pits, surfaces to receive waterproofing, etc.) subject to leveling abrupt offsets as required to accept application of finish materials or waterproofing.

D. Surface Finish – 3.0 (As-cast exposed-to-view): Concrete shall have uniform as-cast surface with minimal additional finishing being anticipated or required.

1. Patch voids larger than 3/4 in. wide or 1/2 in. deep, surface blemishes will not be filled.
2. Remove projections larger than 1/8 in. by grinding without marring surface.
3. Fill tie holes and strike flush with adjacent surfaces, except as otherwise noted.
4. Surface tolerance Class A as specified in ACI 117.
5. Mockup of concrete surface appearance and texture required.

E. Sandblasted Finish: After obtaining as-cast, exposed-to-view surface, light sandblast, sufficient to expose fine aggregate with occasional exposure of coarse aggregate, to produce uniform color and a degree of reveal of approximately 1/16 inch.

F. Sacked Finish: After stripping formwork, thoroughly wet concrete surface, apply grout to fill surface blemishes. Remove all traces of grout from surface by rubbing with clean burlap. Continue curing.

1. Grout: Combine one part cement to one and one-half parts sand by volume, and a 50:50 mixture of acrylic bonding admixture and water to form the consistency of a thick paint. Blend standard Portland cement and white cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

G. At tops of walls and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

3.6 CURING AND PROTECTION

A. General: Start initial curing as soon as free water has disappeared from concrete following finishing. Keep concrete continuously moist for 7 days minimum after placement.

1. Subject to approval of Owner's Representative, application of curing compound may be delayed when specialty compound for moisture vapor emission is used for curing, usually 4 to 24 hours. Slab shall be carefully monitored for moisture content at the surface and compound shall be applied prior to evaporation rate exceeding moisture emission rate.

B. Curing methods:

1. Curing compound: Apply specified curing compound as soon as final finishing operations are complete. Uniformly apply two coats of compound in a continuous operation with second coat at right angles to first. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Recoat concrete surfaces subjected to rainfall within 3 hours after the curing compound application. Maintain compound on the concrete surface throughout the curing period and immediately repair any damage.

    a. Use Type CC-1 compound, unless otherwise designated.
    b. Use Type CC-2 curing and sealing compound for interior floors that remain exposed to view in completed construction. At Contractor’s option, use CC-1 for initial curing; strip and apply CC-2 curing and sealing compound at a later date.
    c. Use Type CC-3 penetrant-type compound for surfaces to receive paint, fluid applied waterproofing or other coatings.
    d. Use Type CC-4 compound for floor areas scheduled to receive glue adhered floor finishes. Refer to Division 07 Section “Vapor Emission and Alkalinity Control for New Concrete for requirements.

2. Moisture-retaining cover: As soon as concrete is sufficiently set to permit application without marring surface, unroll cover over the entire area, laid smooth without folds or bunches of material. Lay blanket in accordance with manufacturer’s instructions, overlapping edges a minimum of 6 inches and extending ends 12 inches beyond area of concrete to be cured. Immediately repair holes or tears that occur within first 5 days using sheeting material and waterproof tape.

    a. Curing paper is preferred cover for slabs to receive adhered floor finishes.
    b. Laminated burlap is preferred cover for concrete with water to cementitious material ratio less than 0.42.
    c. Prewet laminated burlap sheeting as installation progresses.
    d. Maintain cover in place for 7 days for normal weight concrete; cover may be removed in 5 days for lightweight concrete.

3. Moist curing: Continuous misting, sprinkling or ponding. Intermittent wetting is not acceptable.

C. Limitations: Accomplish curing by one of the specified methods, subject to the following limitations.

1. Moisture-retaining cover curing will be the only acceptable method for floors that are scheduled to receive adhered floor finishes.
2. Compound curing will not be permitted for surfaces to which other concrete, mortar or plaster is bonded.
3. Refer to Division 03 Section “Concrete Finishing” for curing of exposed to view slab surfaces scheduled to receive special floor finish.

D. Cold weather requirements: Protect concrete from freezing during the first 7 days after placement.

E. Hot weather requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.7 SAW-CUT JOINTS

A. Construct contraction joints in slabs-on-grade using saw cuts 1/8 inch wide by one-fourth of slab depth, unless otherwise indicated.

B. If joint pattern is not shown, provide joints to create approximately square panels not exceeding 30 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bay, etc.).

C. Sawcut as soon as concrete will bear the weight of equipment and operator, usually 8 to 12 hours after initial finishing.

D. Perform all cuts cleanly and smoothly to a constant and equal depth in as continuous an operation as possible to avoid misalignment of joints. Use only experienced personnel and forms or templates as required to achieve consistent lines.

3.8 CLEANING, PATCHING AND DEFECTIVE WORK

A. Cleaning: Remove curing compounds, form release agents and other materials employed in concrete work that prevent proper application of finishes, sealants, waterproofing materials, or other treatments. Use positive method, as recommended by manufacturer, to achieve complete removal.

1. For floors scheduled to receive glue-adhered floor finishes, chemically strip Type CC-1 curing compound 7 days minimum to 14 days maximum following placement.

B. Repair of formed surfaces: Immediately after form removal, cut out honeycombs, rock pockets, and voids. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat surface of void with neat cement paste. Immediately fill and compact with patching mortar.

1. Use patching mortar for form ties for minor repairs.
2. Use pre-packaged, shrinkage-compensated structural repair mortar, acceptable to Owner's Representative, for larger repairs.

C. Repair of floor slabs for flatness and levelness: Repair floors as necessary to achieve specified finish tolerances and as otherwise required for proper installation of building components.

1. After concrete has cured at least 28 days, correct high areas by grinding.
2. Correct low areas with underlayment installed according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

3.9 GROUTING BASEPLATES

A. Prior to erection, clean and roughen concrete surface beneath baseplate; clean bottom surface of baseplate of bond-reducing materials. After columns have been positioned and plumbed, flow nonshrink grout solidly between bearing surfaces to ensure no voids remain. Comply with manufacturer's recommendations for mixing, placing, finishing and curing of grout.

3.10 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section "Quality Requirements".

B. Testing Laboratory will:

1. Collect and review tickets for each batch of concrete delivered. Annotate water or admixtures added subsequent to batching.
2. Special Inspect concrete placement, as required by CBC Table 1705A.3, for conformance with the Contract Documents.
3. Compressive strength: Sample and test concrete for compressive strength at the frequency prescribed by ACI 318, Section 5.6.2 as modified by CBC Section 1905A.1.2. A sample shall be the average of two 6 by 12 inch cylinders or three 4 by 8 inch cylinders. Cylinders shall be molded and cured in accordance with ASTM C31 and tested in accordance with ASTM C39 at 28 days.

    a. On first day's placement of each concrete mix, mold two additional cylinders and test at 7 days. 7-day testing is not required thereafter.
    b. Where design strength is specified at 56 days, perform testing at 56 days. On first day's placement of concrete mix, mold four additional cylinders; test 2 at 7 days and 2 at 28 days. 7-day and 28-day testing is not required thereafter.
    c. For post-tensioned concrete, mold an additional cylinder for each sample for testing prior to stressing.
    d. For lightweight concrete, take cylinders at point of placement.

4. Slump: ASTM C143; one test at start of placement and every two hours thereafter.

    a. For lightweight concrete, test at truck and point of placement to monitor slump loss.

5. Temperature: ASTM C1064; one test every two hours during hot weather. Make additional tests when warranted by delays in delivery.
6. Air content: ASTM C173; one test hourly at point of placement for mixes with more than 3% air.
7. Wet density: ASTM C138; sample and test lightweight concrete at truck at start of each day's placement. Continue testing until mixes achieve target density.
8. Equilibrium Density: ASTM C567; sample lightweight concrete every 2 hours at point of placement. Oven dry samples and test for dry density in accordance with ASTM C567. Report calculated equilibrium density in accordance with ASTM C567 “quick method”, based on oven dry density plus 3 pcf.
9. Nonshrink grout:

    a. Inspect mixing and placing of nonshrink grout.
    b. Test for compressive strength in accordance with ASTM C109. Make one sample for each 2 hours of grout placement.

C. The Contractor shall pay Testing Laboratory for investigating of low-strength compressive test results in accordance with ACI 318, Section 5.6.5, except where results of test cylinders are not representative of in-place concrete.

3.11 FINISH SCHEDULE

A. The concrete finish types specified in "Table 1 - Finishes for Non-Formed Surfaces" and "Table 2 - Finishes for Formed Surfaces", which follow, shall be used except as otherwise designated on drawings.

1. Exposed surfaces that are scheduled to receive paint, sealers or other thin finish coatings shall be considered "Exposed-to-View".
2. Exposed-to-view Curbs and Stair Risers: Provide monolithic finish by stripping forms while concrete is green and steel-troweling surfaces to a dense, hard finish with corners intersections and terminations slightly rounded.

B. Refer to Section 031000, "Concrete Forming", for formwork requirements for exposed-to-view surfaces.

C. Refer to Division 03 Section “Concrete Finishes” for specialty finishes. In case of conflict, the requirements of “Concrete Finishes” shall take precedence over the requirements herein.

TABLE 1: FINISHES FOR NON-FORMED SURFACES

Surface	Finish	Tolerances	Curing
Floor to receive carpet	Trowel	Moderately Flat $SOF_F = 25$ $SOF_L = 20$	CC-1 or CC-4
Floor to receive resilient flooring	Trowel	Flat $SOF_F = 35$ $SOF_L = 20$	CC-1 or CC-4
Floor to receive thin-set tile	Trowel Refer to Division 09 for subsequent preparation	Flat $SOF_F = 35$ $SOF_L = 20$	Moisture retaining cover or CC-3

Floor to receive epoxy terrazzo	Trowel	Very Flat $SOF_F = 45$ $SOF_L = 25$	Moisture retaining cover (paper)
To receive bonded topping or mortar bed	Scratch	---	Moisture retaining cover
Exposed concrete (utility)	Trowel	Conventional $SOF_F = 20$ $SOF_L = 15$	CC-2 cure/seal or CC-1 cure removed and sealed with CC-2
Polished concrete floor	Trowel	Very Flat $SOF_F = 45$ $SOF_L = 20$	CC-1
Parking	Swirl	---	CC-2
Roof	Float	---	CC-1

3.12 Note: Tolerance SOF_L does not apply to steel frame floors.

TABLE 2: FINISHES FOR FORMED SURFACES		
Surface	Finish	Notes
Concealed, except as otherwise noted.	SF-1.0	
To receive waterproofing or cement plaster	SF-2.0	
Pits (inside face)	SF-2.0	
Exposed to view, building interior utility areas	SF-2.0	
Exposed to view, building interior, public areas	SF-3.0	Refer also to requirements for Architectural Concrete
Exposed to view, building exterior	SF-3.0	Refer also to requirements for Architectural Concrete

END OF SECTION 033000

SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

B. Related Sections include the following:

1. Division 09 Sections for patching and leveling compounds applied with floor coverings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.

C. Mockups: Apply hydraulic-cement-based underlayment mockups to demonstrate surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Apply mockups approximately 100 sq. ft. in area in location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original unopened packages or containers, with manufacturer's label intact and legible.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, sunlight, extreme temperatures, or other detrimental effects.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ARDEX Americas; Ardex V1200.
b. Dayton Superior Corporation; LeveLayer.
c. Euclid Chemical Company (The); an RPM company; Level Magic Lightweight.

2. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.

3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

E. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

D. Sound Control : Install sound control materials according to manufacturer's written instructions.

1. Do not install mechanical fasteners that penetrate through the sound control materials.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.
3. Allowable Tolerance: Maximum deviation from a true plane of 1/4 inch as measured from the line of a 10 foot straightedge placed at any location on the surface. Tolerance shall be non-cumulative.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

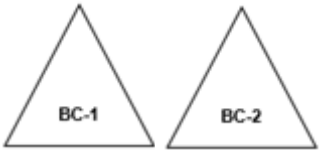
F. Apply surface sealer at rate recommended by manufacturer.

G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416



SECTION 036100 - GROUTED DOWELS IN CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Reinforcing bar dowels installed in hardened concrete using adhesive prepackaged in cartridges.

B. Related Sections:

1. Section 050525 – Post-Installed Concrete Anchors for installation of adhesive anchors for attachment of nonstructural and structural components.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section.

C. CBC: 2013 California Building Code, including provisions applicable to OSHPD regulated facilities.

D. ICC-ES: ICC Evaluation Service:

1. AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements, 2013.

1.4 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittals".

B. Product data for proprietary materials, including epoxy adhesives and nonshrink grout. Include manufacturer's detailed instructions for storage and handling, installation, and special inspection.

1. Include current ICC Evaluation Service Report for adhesives prepackaged in cartridges.

1.5 QUALITY ASSURANCE

A. Cartridge adhesive: Products proposed for use shall have an active ICC Evaluation Service Report evidencing compliance with ICC ES acceptance criteria AC308 for use to resist tension and shear in cracked and uncracked concrete.

1. Installation shall conform to manufacturer's written instructions listed in ICC ES report.

PART 2 - PRODUCTS

2.1 ADHESIVE AND GROUT MATERIALS

A. Cartridge adhesive

~~?. Epoxy Adhesive: Two-component, 100% solids, structural epoxy conforming to ASTMC 881, Type IV; Grade 3; prepackaged in cartridges for manually or pneumatically operated caulk gun and automatically mixed at nozzle. Approved for use in cracked and uncracked concrete in accordance with ICC ES AC308, as demonstrated by an active ICC Evaluation Service Report. Subject to compliance with specified requirements, provide one of the following, or equal:~~

~~?. HIT RE500-SD Adhesive, Hilti Inc.~~
~~?. Set-XP Epoxy Adhesive, Simpson Strong-Tie Co.~~

1. Hybrid adhesive: Two-component, hybrid adhesive prepackaged in cartridges for manually or pneumatically operated caulk gun and automatically mixed at nozzle. Approved for use in cracked and uncracked concrete in accordance with ICC ES AC308, as demonstrated by an active ICC or IAPMO Evaluation Service Report. Subject to compliance with specified requirements, provide one of the following, or equal:

a. HIT -HY 200 Adhesive, Hilti Inc.
~~?. AT-XP Adhesive, Simpson Strong-Tie Co.~~

~~?. Nonshrink grout: Premixed, nonmetallic, noncorrosive product, complying with ASTM C1107, Class B or C, at fluid consistency. Non-bleeding after mixing at a 27 (plus or minus 3 second) flow, ASTM C939, at 45 to 90 degrees F. Will pass through flow cone 45 minutes after initial mixing without the addition of water. Subject to compliance with requirements, provide one of the following:~~

~~?. Euco N.S., Euclid Chemical Co.~~
~~?. Masterflow 928, Master Builders~~

~~?. Five Star Grout, U.S. Grout Corp.~~

2.2 DOWELS

A. Reinforcing bars: ASTM A615, Grade 60, or ASTM A706, deformed. Embedded end shall be free of offsets that interfere with installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be drilled to verify conditions of access, interferences, and existing materials.

B. Locate existing reinforcing steel, which might interfere with drilling, with a suitable metal detector or by chipping.

3.2 PREPARATION

A. Protect existing exposed surfaces from grouting operations.

B. Dowels shall be free of oil, mud, loose rust or other materials that may reduce bond.

3.3 INSTALLATION WITH CARTRIDGE ADHESIVE

A. General: Install anchors in accordance with manufacturer's written instructions, including drilling, hole cleaning, dispensing of epoxy and setting of dowels.

B. Adhesive type: Approved hybrid adhesives shall be acceptable where designated embedment depth is 12 inches or less. Hybrid adhesives shall not be acceptable for dowels with deeper embedment; use epoxy adhesive.

C. Drilling:

1. Drilling equipment: Use electric or pneumatic rotary type drilling hammer with medium or light impact and carbide tipped masonry bit. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking during drilling process.
2. Do not cut reinforcing steel, except with approval of Owner's Representative. Where reinforcing is encountered, drill new hole a minimum of 2 diameters clear at no additional cost to Owner.

D. At overhead applications, use manufacturers standard hole plug to prevent epoxy leakage and temporarily support dowel to prevent movement out of hole. Hybrid adhesive is preferred for overhead application, where embedment depth permits use.

E. Fill abandoned holes with nonshrink grout.

~~?.? INSTALLATION WITH NONSHRINK GROUT~~

~~?. Drill holes to a diameter 1 inch minimum larger than the nominal diameter of the dowels.~~

~~?. Drill holes using water-cooled core drilling equipment. Roughen surface by method acceptable to Owner's Representative.~~

~~?. Clean hole by flushing with water hose inserted to back of hole until water runs clear, brush twice with round steel wire bristle brush of appropriate diameter, and flush with hose until water runs clear.~~

~~?. Place reinforcing bar into hole. Provide centralizing devices as required to maintain bar at center of core.~~

~~?. Mix and place grout at fluid consistency in accordance with manufacturer's recommendations.~~

~~?. Cure by covering with wet cloth for 3 days minimum or by coating with curing compound.~~

3.4 CLEANING

A. Clean excess epoxy from around holes before it hardens only on surfaces that will not be exposed to view.

B. On surfaces that will be exposed to view, allow epoxy to cure then chip away hardened epoxy. Surfaces shall be repaired to match existing finish to the satisfaction of the Owner's Representative.

3.5 PROTECTION

A. Protect dowels from accidental disturbance during setting time specified by manufacturer.

B. Do not place pull-out or shear loads on dowels during curing time specified by manufacturer.

3.6 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality".

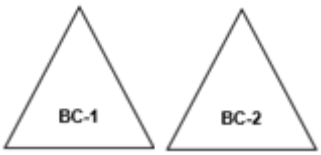
B. Testing Laboratory will:

1. Review manufacturer's recommended installation and inspection procedures, as contained in ICC Evaluation Service Report.
2. Special Inspect installation for conformance with Contract Documents, manufacturer's recommendations, and requirements of the applicable ICC-ES report.

3. Test dowels in accordance with requirements of CBC Section 1916A.7 for adhesive anchors.

    a. Testing Procedure: Use hydraulic ram testing procedure of CBC Section 1913A.7.4 for testing of bond (confined configuration).
    b. Test Loads: As shown on Drawings, or as otherwise designated by Owner's Representative, in conformance with test load requirements CBC Section 1913A.7.2.
    c. Testing Frequency: 100 percent, except frequency can be reduced in accordance with CBC Section 1913A.7.3.
    d. Acceptance Criteria: Maintain test load for a minimum of 15 seconds with no discernible movement of dowel out of hole.

END OF SECTION 036100



SECTION 050525 - POST-INSTALLED CONCRETE ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Post-installed mechanical anchors in concrete, including:

   a. Wedge-type expansion anchors approved for use for seismic applications in cracked and uncracked concrete.
   b. Screw-type drilled-in anchors approved for use for seismic applications in cracked and uncracked concrete.

2. Post-installed adhesive anchors in concrete, approved for use for seismic applications in cracked and uncracked concrete.

B. Related Sections:

1. Section 036100 - Grouted Dowels: For reinforcing bar dowels installed in hardened concrete using adhesive.

1.2 REFERENCES

A. ICC-ES or IAPMO-ES Evaluation Report: Evaluation Report issued by the ICC or IAPMO Evaluation Service demonstrating compliance with provisions of the International Building Code, 2009 or 2012 Edition.

1.3 DEFINITIONS

A. Nominal embedment depth: Minimum length from concrete surface to end of anchor following completion of anchor installation. For wedge-type anchors, nominal embedment depth shall be measured following application of installation torque.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01, "Submittal Procedures".

1. Manufacturer's product data.
2. Manufacturer’s installation instructions.
3. ICC-ES or IAPMO-ES Evaluation Reports.

4. Installer Qualifications & Procedures: Maintain a list of personnel trained on post-installed anchor installation in accordance with Qualification requirements. Include training date, name of manufacturer's representative, and types of anchors included.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Anchors shall be installed by personnel with prior training for the project by the anchor manufacturer's representative.

1. Training shall be conducted by manufacturer's representative and shall consist of a review of the complete installation process for drilled-in anchors, including:

a. Drilling equipment and procedures.
b. Hole cleaning.
c. Anchor installation.
d. Proof loading.

2. Each installer shall install a minimum of 3 anchors during training, including each type of anchor intended for use. Install a minimum of one anchor overhead through steel deck, where condition will be encountered in Work.
3. Testing Laboratory representative shall attend installer training.

B. Certifications: Anchors shall have an active ICC-ES or IAMPMO-ES Evaluation Report in accordance with the following ICC-ES Acceptance Criteria for use to resist tension and shear in cracked and uncracked concrete:

1. Mechanical anchors: Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC 193).
2. Adhesive anchors: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements (AC 308).

PART 2 - PRODUCTS

2.1 MECHANICAL ANCHORS

A. General: Anchors shall be tested and approved for use in cracked and uncracked concrete in accordance with ICC-ES AC 193.

1. Anchors installed through underside of steel deck shall be tested and approved for installation through the soffit of concrete-filled metal deck assemblies in accordance with ICC-ES AC 193.

B. Acceptable Products: Where anchor manufacturer and product are indicated on drawings, provide designated product.

1. Contractor shall be allowed to substitute products of other manufacturer's, subject to demonstrating equivalent tension and shear strength to specified anchor, under project installation conditions.

2. Where anchor design is prepared by Trade Subcontractor's Engineer, use product designated by Trade Subcontractor's Engineer, subject to meeting requirements of this Section.

C. Wedge Anchors: Wedge type, torque-controlled expansion anchors. Size and nominal embedment depth as indicated on Drawings.

1. Material: At dry locations, provide carbon steel anchors with zinc plating in accordance with ASTM B633, SC1, Type III; except as otherwise indicated on drawings. At wet locations and where designated on Drawings, provide AISI Type 304 or Type 316 stainless steel anchors with manufacturers matching nut and washer.
2. Acceptable Products: Where anchor product and manufacturer are not indicated on drawings or designated by Trade Subcontractor's Engineer, provide one of the following:

a. Kwik Bolt TZ, by Hilti, Inc.

D. Screw Anchors: Hardened steel, screw-type anchors or rod hangers approved for use in cracked and uncracked concrete. Diameter and nominal embedment depth as indicated on drawings.

1. Limitations: Anchors shall be used in dry interior environments only.
2. Material: Case hardened low carbon steel, with zinc plating in accordance with ASTM B633, SC1, Type III.
3. Acceptable Products: Where anchor product and manufacturer are not indicated on drawings or designated by Trade Subcontractor's Engineer, provide one of the following:

a. Kwik HUS-EZ screw anchor and HUS-EZ1 rod hanger, by Hilti.
b. Titen HD Screw Anchor and Titen HD Rod Hanger, by Simpson Strong-Tie Co. Inc.
c. Wedge-Bolt+ and Vertigo+ Rod Hanger, by Powers Fasteners.

2.2 ADHESIVE ANCHORS

A. General: Adhesive anchoring system shall be tested and approved for use to resist seismic forces (IBC Seismic Design Categories A to F) in cracked and uncracked concrete in accordance with ICC-ES AC 308.

B. Acceptable Products: Where adhesive anchoring system manufacturer and product are indicated on drawings, provide designated product.

1. Contractor shall be allowed to substitute products of other manufacturer's, subject to demonstrating equivalent tension and shear strength to specified anchor, under project installation conditions.
2. Where anchor design is prepared by Trade Subcontractor's Engineer, use product designated by Trade Subcontractor's Engineer, subject to meeting requirements of this Section.

C. Adhesive: Where adhesive product and manufacturer are not indicated on drawings or designated by Trade Subcontractor's Engineer, provide one of the products listed below:

1. Acceptable Products:

~~?. HIT RE500-SD Adhesive, by Hilti, Inc.~~

~~?. Set-XP Epoxy Adhesive, by Simpson Strong-Tie Co. Inc.~~

a. HIT -HY 200 Adhesive, Hilti Inc.
~~?. AT-XP Adhesive, Simpson Strong-Tie Co.~~

D. Threaded Rod:

1. Material: Unless otherwise indicated on the drawings, furnish carbon steel threaded rods conforming to ASTM A36 or ASTM A193 Type B7.
2. Finish: Furnish carbon steel rods with zinc plating in accordance with ASTM B633, SC1, Type III at dry interior locations. Furnish carbon steel rods with hot-dipped galvanized coating complying with ASTM A153 at exterior and damp interior locations.
3. As indicated on the drawings, provide Type 304 or Type 316 stainless steel anchors with manufacturers matching nut and washer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install anchors in conformance with manufacturer's written instructions.

B. Examination:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Notify Owner's Representative for clarification where reinforcing steel or other embedded items require relocation of anchors or cutting of reinforcement.
2. Notify Owner's Representative for clarification where anchors appear to be located too close to edge of concrete, in particular where edge is not shown on Drawing detail.
3. Notify Owner's Representative for clarification where concrete thickness is inadequate to achieve specified anchor embedment. Minimum concrete thickness shall allow for specified embedment, plus one anchor diameter allowance for overdrilling, plus 3/4 inch minimum cover from end of hole to concrete surface.

C. Drilling:

1. Do not drill holes in concrete until mix has achieved full design strength.

2. Drill holes with rotary impact hammer drills using carbide-tipped bits with diameter as recommended by anchor manufacturer. Reduce impact as hole approaches concrete surface as necessary to prevent cracking and spalling. Use core bits only with approval of Owner's Representative and only for mechanical anchors.
3. Holes shall be drilled perpendicular to the concrete surface, unless otherwise shown on Drawings. Anchors shall be drilled to within 5 percent of specified alignment.
4. Exercise care in drilling to avoid damaging existing reinforcing, conduits and other embedded items.

D. Wedge Anchors:

1. Drill holes designated nominal embedment depth plus one anchor diameter minimum. End of hole shall be 3/4 inch minimum clear from concrete surface.
2. Remove dust and debris with pressurized air, in accordance with manufacturer's instructions.
3. Set anchors to designated nominal embedment depth, plus an allowance for withdrawal during torque tightening.
4. Tighten using a torque wrench to manufacturer's recommended installation torque. Following attainment of 10% of recommended torque, achieve 100% of designated torque within 5 or fewer turns of the nut. If torque is not achieved, the anchor shall be removed and replaced unless otherwise directed by the Owner's Representative.

E. Screw Anchors:

1. Take particular care to achieve proper hole diameter. Use only sharp bits with diameter recommended by manufacturer. Use drilling equipment and methods to prevent enlargement of holes by wobble.
2. Remove dust and debris with pressurized air, in accordance with manufacturer's instructions.
3. Install the anchor in accordance with manufacturer's instructions with an impact wrench. Take care not to overtighten anchor; note that manufacturer's maximum installation torque is not the torque intended to be achieved during proper installation.

F. Adhesive Anchors:

1. Drill holes to diameter recommended by manufacturer with rotary impact hammer drills using carbide-tipped bits; core bits shall not be permitted.
2. Thoroughly clean holes by brushing and blowing with compressed air in accordance with manufacturer's instructions. Clean immediately prior to anchor installation under observation of Special Inspector.
3. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole.
4. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.2 REPAIR OF DEFECTIVE WORK

A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.3 FIELD QUALITY CONTROL

A. Testing Laboratory will:

1. Review manufacturer's recommended installation and inspection procedures, as contained in Evaluation Service Report.
2. Special Inspect installation for conformance with Contract Documents, manufacturer's recommendations, and requirements of the applicable ES report. Verify that anchors are being installed by trained installers.

    a. Periodically inspect installation of mechanical anchors.
    b. Continuously inspect installation of adhesive anchors during hole cleaning and anchor installation.

3. Test anchors in accordance with requirements of CBC Section 1913A.7, including testing frequency and method for adhesive anchors.

    a. Test Loads: As shown on drawings, or as otherwise designated by Owner’s Representative, in conformance with test load requirements CBC Section 1913A.7.2.
    b. Testing Frequency: 100 percent, except frequency can be reduced in accordance with CBC Section 1913A.7.3.

END OF SECTION 050525

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Structural steel.

B. Related Sections include the following:

1. Section 031000 – Formwork, for installation of anchor bolts and other steel parts that are embedded in concrete to receive structural steel.
2. Section 033000 – Cast in Place Concrete for grouting of baseplates and bearing plates.
3. Section 053000 – Steel Decking for provision of shear connector studs that are field installed to tops of beams.

1.3 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where designated in this Section. Use applicable year of adoption or revision as published in AISC 360-10.

C. CBC: 2013 California Building Code, including provisions applicable to OSHPD regulated facilities.

D. Evaluation Report: Where designated in this Section, products shall have an active Evaluation Report evidencing compliance with provisions of the 2012 International Building Code. Reports by ICC Evaluation Service, Inc. or IAPMO shall be acceptable.

E. American Institute of Steel Construction’s

1. AISC 303: Code of Standard Practice for Steel Buildings and Bridges, 2010.

a. The General Conditions, Special Conditions and Division 1 shall govern in the case of conflicts with provisions of the AISC 303.

2. ANSI/AISC 341: Seismic Provisions for Structural Steel Buildings, 2010.

3. ANSI/AISC 360: Specification for Structural Steel Buildings, 2010.

F. American Welding Society's

1. AWS C4.1: Criteria for Describing Oxygen-Cut Surfaces and Oxygen Cutting Surface Roughness Gauge, latest edition.
2. AWS D1.1: Structural Welding Code, 2010.
3. AWS D1.8: Structural Welding Code – Seismic Supplement, 2009.

G. Research Council on Structural Connections'

1. RCSC Specification: Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2009.

H. SSPC: Latest edition of Society for Protective Coatings surface preparation and painting specifications apply where cited in this Section.

1.4 DEFINITIONS

A. Structural Steel: As classified by Section 2 of AISC 303.

B. Protected Zone: Area of member, designated in Contract Documents, where limitations apply to the making of attachments by the fabricator, erector and other trades.

C. Seismic Load Resisting System (SLRS): Members and connections designed to resist seismic forces, as designated on the drawings.

1.5 SUBMITTALS

A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittal Procedures".

1. Requirements of "Submittal Procedures" supersede provisions of Section 4.4 of AISC 303 Code, indicating time for review of shop drawings.

B. Shop Drawings: Show complete information necessary for the fabrication and erection of structural-steel components in accordance with ANSI/AISC 360.

1. Identify surface preparation and finish.

C. Mill Test Reports: Submit test reports certifying compliance with specified standards to Testing Laboratory for record purposes.

1. Steel.
2. Bolts, nuts and washers.
3. Welding filler materials, fluxes and shielding gases.
4. Shear connector studs.

D. Product Data: For each type of product indicated, including but not limited to weld filler materials, shop primers, bar couplers and deformed bar anchors.

E. Welder Performance Qualification Records (WPQR's). Submit to Testing Laboratory for record purpose.

F. Welding Procedure Specification (WPS) for each different welded joint proposed for use, whether prequalified or qualified by testing.

1. Prepare in accordance with AWS D1.1 requirements.
2. Include procedure qualification record (PQR) for procedures qualified by testing.
3. For Demand Critical welds, conform to additional requirements of AWS D1.8.
4. Allow sufficient time for review by Testing Laboratory in addition to review by Owner's Representative.

G. High strength bolt installation procedure.

H. Samples: As requested by the Testing Laboratory.

1.6 QUALITY ASSURANCE

A. Comply with applicable provisions of AISC 303, ANSI/AISC 341, ANSI/AISC 360, except where more stringent requirements are shown or specified.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Certification Program and is designated an AISC Certified Plant, Category "STD" at time of bid.

C. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS D1.1.

1. Welders performing Demand Critical welds made through a beam web access hole or gusset plate access hole shall have Supplemental Welder Qualification for Restricted Welding in accordance with AWS D1.8.

1.7 COORDINATION

A. Provide metal templates and setting drawings for installation of anchorage items embedded in other work.

B. Furnish embedded anchorage items to avoid delays to other Work.

C. Survey embedded items for proper location prior to delivery of steel.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. General: All steel shall be identified as required by CBC Section 2203A.1. Steel that is not properly identified shall be tested to show conformance with requirements of applicable ASTM Standard at Contractor's expense.

B. W-Shapes: ASTM A992.

C. Channels and Angles: ASTM A36; except ASTM A572, Grade 50 may be substituted at Fabricator's option to suit material availability.

1. Furnish ASTM A572, Grade 50 material where designated on drawings.

D. Plates and Bars: Furnish Grade 50 material, unless otherwise designated.

1. Grade 50: ASTM A572, Grade 50; ASTM A588, Grade 50; or ASTM A529, Grade 50 or Grade 55.

a. Grade 50 material shall be acceptable for all uses, except bolted shear tabs at beam-to-column connections.

2. Grade 36: ASTM A36.

a. Provide Grade 36 material for bolted shear tabs at beam-to-column connections and where designated on drawings.

E. Pipes: ASTM A53, Type E, Grade B.

F. Structural Tubing:

1. Square and rectangular HSS: ASTM A500, Grade B.
2. Round HSS: ASTM A500, Grade B.

2.2 BOLTS, ANCHORS AND CONNECTORS

A. High Strength Bolts: One of the following, unless otherwise designated on Drawings.

1. ASTM A325, Type 1, heavy hex structural bolts with ASTM A563, Grade C or DH heavy hex nuts and ASTM F436 hardened washers.
2. ASTM F1852, Type 1, round head tension control bolts with ASTM A563, Grade C or Grade DH heavy hex nuts and ASTM F436 hardened washers.

B. A 490 Bolts: Provide where designated on Drawings.

1. ASTM A490, Type 1, heavy hex structural bolts with ASTM A563, Grade DH heavy hex nuts; ASTM F436 hardened washers, and ASTM F959, Type 490 direct-tension indicator washers.
2. ASTM F2280, Type 1, round head tension control bolts with ASTM A563, Grade DH heavy hex nuts and ASTM F436 hardened washers.

C. ASTM A307 Bolts: ASTM A307, Grade A, hex headed bolts furnished with ASTM A563, Grade A, hex nuts.

D. Anchor Bolt Assembly:

1. Anchor rod: ASTM F1554, Grade 36; end threaded.

2. Head: Form head with ASTM A563, Grade A, heavy hex nut. Lock against loosening with suitable jam nut.
3. Nuts: ASTM A563, Grade A, heavy hex.
4. Washer: Provide steel plate washer of sufficient size to completely cover hole in baseplate; minimum thickness shall be 1/3 of bolt diameter.

E. Threaded Rods: ASTM A36 end threaded round bar. Nuts shall conform to ASTM A563, Grade A, hex.

1. Accessories, including clevises and turnbuckles, shall conform to ASTM A108, Grade 1035, cold-finished carbon steel; and capable of developing specified tensile strength of rod.

2.3 WELDING CONSUMABLES

A. General: Filler materials and fluxes shall conform to requirements of AWS D1.1; of suitable type for base metals being welded and the intended application.

1. Electrodes for SMAW shall be low hydrogen.

B. Filler and weld metal used for welds of Seismic Lateral Resisting System (SLRS) members and connections shall conform to additional requirements of AWS D1.8, Section 6.3.

C. Filler and weld metal used for complete-joint-penetration Demand Critical welds shall conform to additional requirements of AWS D1.8, Sections 6.3.5, 6.3.6, 6.3.7 and 6.3.8.

2.4 OTHER ITEMS

A. Primer Paints:

1. Type A Primer: Fast-drying, rust-inhibitive, chromate- and lead-free modified alkyd primer. Acceptable Products: Series 10 by Tnemec, 42 Series by Maclac, or approved equal.
2. Type B Primer: SSPC-Paint 20, Type II. Organic, zinc-rich primer; containing less than 0.002% lead. Acceptable Products: Series 90-97 Tneme-Zinc by Tnemec, Carbozinc 621 by Carboline, or approved equal.

B. Galvanizing Repair Paint: ASTM A780.

2.5 FABRICATION

A. Fabricate structural steel in accordance with AISC 303 and ANSI/AISC 360.

1. Conform to additional requirements of ANSI/AISC 341 for members and connections of the Seismic Load Resisting System.
2. Conform to additional requirements of Section 051210 - Architecturally Exposed Structural Steel for AESS members and connections.

B. Thermal Cutting:

1. Make cuts by machine or using mechanical guide.
2. Processes shall be limited to Plasma Arc or Oxyfuel Gas processes, except as approved by Owner's Representative.
3. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

D. High Strength Bolted Connections: Install bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and joint specified.

1. Bolt installation: Pretensioned, except where otherwise designated on Drawings.
2. Faying surfaces: Class A surfaces, in accordance with requirements for slip-critical connections.
3. Hole type: Standard, except where designated on Drawings.

    a. Do not punch holes in material greater than 1/2 inch in thickness, unless approved in writing by Owner's Representative.

E. Welding:

1. Weld in accordance with ANSI/AISC 360 and AWS D1.1 using manual shielded arc method (SMAW), flux cored arc method (FCAW), or gas shielded arc method (GMAW).
2. Weld in accordance with welding procedure specifications (WPS's) for joint, which are to be available to welders and inspectors during the production process.
3. Groove welds shall be complete joint penetration welds, unless designated otherwise on drawings. Groove preparation is at Contractor's option, subject to qualification in accordance with AWS D1.1.

    a. Use double bevel groove welds for sections thicker than 1-1/2 inches, wherever practical.

4. Partial penetration welds shall have an effective throat thickness as designated on drawings. Groove preparation is at Contractor's option, subject to qualification in accordance with AWS D1.1.
5. End dams shall not be used, except at the outboard end of weld tabs that are removed. Provide beveled transitions at changes in groove profile.
6. For members and connections of the Seismic Load Resisting System (SLRS), conform to supplemental requirements of AWS D1.8 and the following:

    a. Use filler materials specified for SLRS welds.
    b. Weld access holes for complete penetration beam flange to column connections shall be shaped in accordance with AWS D1.8, Paragraph 6.9.1.2, "Alternate Geometry"; and conform to quality requirements of Paragraph 6.9.2.

7. Demand Critical welds: Conform to requirements for welding of members and connections of the SLRS, the supplemental requirements of AWS D1.8 applicable to Demand Critical welds, and the following:

a. Use filler materials specified for Demand Critical welds.
b. Complete penetration welds made through access holes in member webs or gusset plates shall follow the welding sequence of AWS D1.8, Paragraph 6.14.
c. Remove backing bars where designated on drawings.
d. Provide a reinforcing fillet at locations where backing bars are removed.
e. Butt joints of parts of unequal thickness or width, shall have a smooth transition between offset surfaces in accordance with provisions of AWS D1.1 for tension joints.

8. Weld reinforcing steel bar couplers to structural steel in accordance with AWS D1.1 using qualified procedures and in accordance with manufacturer's recommendations.

F. Studs: Automatically end weld headed studs and deformed bar anchors in accordance with AWS D1.1 and manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and steel member.

2.6 FINISHES

A. General:

1. Cleaning: All steel shall be free of oil and grease. Clean as required in accordance with SSPC SP1 "Solvent Cleaning".
2. Preparation: All steel shall be free of loose mill scale and foreign matter. Clean as required by SSPC SP 2 "Hand Tool Cleaning".

B. Unpainted: Structural steel at the building interior that is concealed by finishes or fireproofed in the completed construction may remain unpainted.

1. Steel may be prime painted at Contractor's option, except for the following:

a. Members to receive spray fireproofing.
b. Top surfaces of beams to receive welded shear connector studs or weld-attached steel deck.
c. Surfaces in contact with concrete, except initial two inches.

C. Interior Prime Painted: Prime paint interior surfaces that will remain visible in the completed construction, including steel at penthouses.

1. Surface preparation: SSPC SP3 "Power Tool Cleaning", except prepare AESS surfaces in accordance with SSPC 6 "Commercial Blast Cleaning".
2. Primer: Type A, at 2.5 mils dry film thickness. Where steel is scheduled to be finish painted, verify that primer is compatible with finish painting systems.
3. Do not paint faying surfaces of high strength bolted connections and within 1 inch of field weld locations.

D. Exterior Prime Painted: Prime paint surfaces that are outside the weatherproof envelope, including concealed surfaces.

1. Surface preparation: SSPC SP6 "Commercial Blast Cleaning". Ease corners of plates and shapes to 1/16-inch minimum chamfer.
2. Primer: Type B, at 3 mils dry film thickness. Verify that primer is compatible with finish painting systems.
3. Do not paint within 1 inch of field weld locations; paint faying surfaces of bolted connections.
4. Schedule application of intermediate coats prior to erection, where steel cannot be properly field coated after erection.

E. Hot-Dip Galvanizing: Hot dip galvanize items designated on drawings.

1. Galvanize items in accordance with ASTM A123.
2. Provide hot dip galvanized fasteners for connection of galvanized items, except do not galvanize A490 bolts. Galvanize in accordance with ASTM A153, Grade 50.
3. Obtain approval for locations of vent holes in closed sections.

2.7 SOURCE QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality Requirements".

B. Testing Laboratory will:

1. Collect mill test reports, verifying compliance with specified requirements.
2. Review welding procedure specifications for compliance with applicable requirements of AWS D1.1 and AWS D1.8.

    a. Verify that machine settings and travel speed correspond to electrode manufacturer’s recommendations.

3. Collect and review qualifications of welders.
4. Review material identification and control procedures for conformance with requirements of the CBC Section 2203A.2.
5. Sample and test high strength bolts, nuts, and washers as required by CBC Section 2213A.1. Sample size shall be in accordance with ASTM F1470, Sample Level C. Perform testing in accordance in accordance with ASTM F606.

    a. Test bolts, nuts, and washers for hardness.
    b. Test bolts for tensile strength using the "Axial Tension Testing of Full Size Specimens" method.
    c. In addition to component testing, perform assembly testing for "Twist Off" type tension control bolts, using the "Installation and Tension Test" method of ASTM F1852.

6. Inspect high-strength bolting in accordance with requirements of the CBC Section 1705A, “Special Inspections”. Perform QA inspection tasks listed in ANSI/AISC 341, Section J7, “Inspection of Bolting”.
7. Inspect shop and field welding in accordance with requirements of CBC Section 1705A, “Special Inspections”. Perform QA inspection tasks listed in ANSI/AISC 341, Section J6.1, “Visual Welding Inspection”.

8. Ultrasonic test 100 percent of complete joint penetration welds in materials 5/16-inch or greater. Perform testing in accordance with procedures and acceptance criteria of AWS D1.8, Section 7.10, “Ultrasonic Testing”.

    a. Apply requirements for seismic connections to all connections.
    b. Subject to approval of authority having jurisdiction, the amount of testing will be permitted to be reduced in accordance with provisions of ANSI/AISC 341, Section J, paragraph J6.2g, “Reduction of Percentage of Ultrasonic Testing”.

9. For members and connections of the Seismic Lateral Resisting System, perform additional nondestructive testing (NDT) of welds and base metal adjacent to welds in accordance with provisions of ANSI/AISC 341, Section J, paragraph J6.2. Perform tests in accordance with applicable requirements of AWS D1.8, Section 7, “Inspection”.

    a. MT inspection of k-area base metal in web, where welding of continuity plates, doubler plates or stiffener plates occurs in k area.
    b. MT inspection of beam-to-column CJP’s.
    c. UT testing of base metal, including baseplates, thicker than 1-1/2 inches for laminations where connected material is greater than ¾ inches.
    d. MT testing of beam copes and access holes at welded connections where flanges are thicker than 1-1/2 inches.

10. Periodically, inspect and test stud welding as required by CBC, in accordance with AWS D1.1. Review pre-production testing and qualification, periodically inspect welding, and perform verification inspection and testing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine construction to support steel erection and verify the following:

    1. Location and elevation of bearings and anchor bolts are correct.
    2. Other conditions adversely affecting erection of steel are absent.

B. Do not begin erection before unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Erect structural steel in accordance with AISC 303 and ANSI/AISC 360.

    1. Conform to additional requirements of ANSI/AISC 341 for members and connections of the Seismic Load Resisting System.
    2. Conform to additional requirements of Section 051210 - Architecturally Exposed Structural Steel for AESS members and connections.

B. Where erection requires performing work of fabrication on site, conform to applicable requirements of “Fabrication”.

1. Thermally cut edges shall be made with mechanical guides and meet requirements of AWS D1.1, Section 5.15 for acceptable roughness, notches and gouges.

C. Field corrections will not be permitted without the prior approval of the Owner's Representative.

D. Field Touch-up Painting:

1. Touch-up paint field welded connections and abrasions using same paint used for shop priming.
2. Prior to painting welds, thoroughly chip and wire brush. Wash with dilute solution of phosphoric acid (approximately 5%) and rinse with water. Allow surface to dry prior to painting.
3. Touch up galvanized surfaces in accordance with ASTM A780.

3.3 CLEANING

A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of fire-retardant coating, paint or concrete.

3.4 PROTECTION

A. Maintain warning signage for Protected Zones during construction period.

1. Install temporary signage prior to erection.
2. Install permanent signage as soon as practical following the masking of temporary signage by spray fireproofing or finish painting.

3.5 FIELD QUALITY CONTROL

A. Inspection and testing will be performed in accordance with procedures and administrative requirements of Division 01 Section, "Quality Requirements".

B. Testing Laboratory will:

1. Inspect and test field high strength bolting and welding in accordance with "Source Quality Control".
2. Inspect Protected Zones for:

a. Discontinuities created by fabrication or erection operation, such as tack welds and erection aids.
b. Welded shear stud and decking attachments, except deck spot welds shall be permitted.
c. Welded, bolted, screwed, or shot in attachments for attachment of edge angles and the Work of other trades.
d. Placement of suitable warning signage.

END OF SECTION 052100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for curtain tracks and IV tracks.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Aluminum plank grating.
6. Shelf angles.
7. Abrasive metal treads.
8. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Grout.
2. Plank gratings.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections. Provide Shop Drawings for the following:

1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary protective cover on anodized aluminum finished surfaces.

B. Store components in original containers in a clean, dry location.

C. Handle components with equipment of sufficient size to preclude hazard to personnel or damage to components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

~~A. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:~~

~~1. Walkways and Elevated Platforms Other Than Exits: Uniform load as indicated on Drawings.~~

~~B. Seismic Performance: Gratings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.~~

~~1. Component Importance Factor: 1.5.~~

~~C.~~A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness.

E. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

F. Extruded Bars and Shapes: ASTM B 221, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

G. Aluminum Sheet: ASTM B 209, Alloy 5052-H32.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A 489.

G. Machine Screws: ASME B18.6.3.

H. Lag Bolts: ASME B18.2.1.

I. Wood Screws: Flat head, ASME B18.6.1.

J. Plain Washers: Round, ASME B18.22.1.

K. Lock Washers: Helical, spring type, ASME B18.21.1.

~~K.~~L. Walkway Plank Anchor Clip: Plank manufacturer's clip made for fitting into diamond grate pattern and securing plank to structure. Hot dipped galvanized with round hole for bolt. McNichols GRIP STRUT.

~~L.~~M. Expansion Anchors: Anchors bolt and sleeve assembly capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

~~M.~~N. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Basis-of-Design Product: Tnemec Company, Inc.; Tneme-Zinc 90-97.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. High Strength: when set at "Plastic" or "Flowable" consistency, 6,000 psi @ 7 days, 8,500 @ 28 days. Provide grout specifically recommended by manufacturer for interior and exterior applications.
~~D.~~ 1. Basis-of-Design Product: Euclid NS Grout

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction with mitered corners, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Fabricate units with minimum number of joints for field connections.

C. Fabricate supports for curtain and IV tracks from steel channels of sizes indicated with attached hangers, anchors and braces as indicated. Coordinate with curtain and IV track shop drawings for locations of channels and spacing of holes in channels for hanger bolts.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 EXTRUDED-ALUMINUM PLANK GRATINGS

A. Basis-of-Design Product: McNichols, GRIP STRUT Plank Grating.

1. Diamond surface grating with serrated surface pattern.
~~1.~~2. Alloy: 5052
3. Depth: 2 inches.
~~2.~~4. Gauge: 10 gauge / 0.100 inch
~~3.~~5. Width: nominal 12-inches typical, and as needed.
~~4.~~6. Lengths: 12 foot span.
~~5.~~7. Finish: Mill finish, as fabricated.

2.8 ABRASIVE METAL TREADS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

B. Basis-of-Design Product: McNichols, GRIP STRUT Stair Tread.

1. Custom size: 11-inch width, 36" length.
2. Material: Diamond surface grating, 12 gage steel, 11/2" deep, galvanized for exterior use.
3. End plates with bolt holes.
4. Provide nosings.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units.

E. Apply clear lacquer to concealed surfaces of extruded units.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications to attain a uniform dry film thickness of 1.0 mil for each coat, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply one coat of shop primer, except apply two coats to surfaces that will be inaccessible after assembly or installation.

2.14 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.15 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions where metal fabrications will be installed.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for curtain tracks, IV tracks securely to, and rigidly brace from, building structure.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING METAL PLANK GRATINGS

A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.

B. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

3.6 INSTALLING TREADS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel pipe tube railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and professional engineer.

B. Welding certificates.

C. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Wagner, R & B, Inc.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.

b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchorscapable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:

1. As detailed.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.9 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions where railings will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 060660 - SCHEDULES FOR PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the Plastic Fabrications as shown and specified in the described system(s): Adjust list below to suit Project

1. Feature Wall
2. Wall Cladding

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.

B. Submit product test reports from a qualified independent 3rd party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Test reports required are:

a. Rate of Burning (ASTM D 635)
b. Self-Ignition Temperature (ASTM D 1929)
c. Density of Smoke (ASTM D 2843)
d. Room Corner Burn Test (NFPA 286)
e. Extent of Burning (UL 94)
f. Impact strength (ASTM D 3763)
g. Safety glazing impact resistance (ANSI Z97.1-2004)
h. UPITT Test for Combustion Product Toxicity
i. Dynamic environmental testing (ASTM standards D 5116 and D 6670)

C. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.

D. Samples for Initial Selection:

1. Submit minimum 2-inch by 2-inch samples. Indicate full color, texture and pattern variation.

E. Samples for Verification:

1. Submit minimum 4-inch by 4-inch sample for each color of Plastic Fabrications

F. Mockups:

1. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
2. Build mockup of each type of Plastic Fabrications.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications

1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least two (2) consecutive years and which can show evidence of those materials being satisfactorily used on at least three (3) projects of similar size, scope and location. At least three (2) of the projects shall have been successful for use two (2) years or longer.
2. Manufactured panels must be produced from a minimum of 40% post-industrial recycle content. This recycle content must be certified by a recognized 3rd party certification group, such as Scientific Certification Systems (SCS).
3. Manufacturer must offer a documented reclaim process that will take back, at the manufacturers cost, panels that are at their end-of life cycle. Return process is preceded by following requirements highlighted in Section 024200 Removal and Salvage of Construction Materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver Plastic Fabrications and specified items in manufacturer's standard protective packaging.

B. Do not deliver Plastic Fabrications, components and accessories to Project site until areas are ready for installation.

C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.

D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.

E. Before installing Plastic Fabrications, permit them to reach room temperature.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install Plastic Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

A. Manufacturer's Special Warranty on polymer panel system: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.

1. Warranty Period: 1 year after the date of substantial completion.

B. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500

2.2 MATERIALS

A. Bear Grass produced from Varia Ecoresin® Sheet

1. Engineered polyester resin
2. Thickness: 1/4"

B. Interlayer Materials: Compatible with polyesters and bonding process to create a monolithic sheet of material when complete.

C. Sheet minimum performance attributes:

1. Rate of Burning (ASTM D 635). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
2. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 650°F.
3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 75%.
4. Room Corner Burn Test (NFPA 286). Material must meet Class A criteria at ' thickness as described by the 2003 International Building Code.
5. Extent of Burning (UL 94). Must submit UL card.

6. Impact strength. Minimum impact strength test as measured by ASTM D 3763 of 20 ft. lbs. (for durability, shipping, installation, and use).
7. Safety Glazing. Material must attain a Class A impact rating in accordance with ANSI Z97.1-2004 at 1/8" thickness.
8. UPITT Test for Combustion Product Toxicity: Product must be recorded as "not more toxic than wood".
9. Dynamic environmental testing (ASTM standards D 5116 and D 6670). Panels must not have detectable VOC off-gassing agents and must be have Greenguard Indoor Air Quality certified.
10. Panels must be produced from a minimum of 40% post-industrial recycle content. This recycle content must be certified by a recognized 3rd party certification group, such as Scientific Certification Systems (SCS).
11. Building Approvals: Plastic Fabrications are to have been evaluated and must be registered with and comply to requirements of the following jurisdictions:

    a. Los Angeles Department of Building and Safety (Product must have a LARR number) for use as Light-transmitting Panels

2.3 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use included hardware specifically designed for 3form Ditto.

D. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.

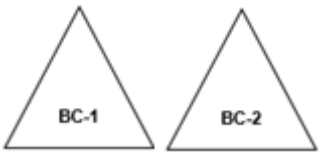
B. Utilize fasteners provided by manufacturer.

C. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

3.3 CLEANING AND PROTECTION

A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

END OF SECTION 060660



SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NHLA: National Hardwood Lumber Association.
2. NLGA: National Lumber Grades Authority.
3. WCLIB: West Coast Lumber Inspection Bureau.
4. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATION SUBMITTALS

A. Research/Evaluation Reports: For the following, showing compliance with the 2013 California Building Code (CBC):

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground. Comply with the 2013 California Building Code (CBC) Section 2303.1.8.

1. Preservative Chemicals: Acceptable to OSHPD and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review in accordance with the 2013 California Building Code (CBC) Section 2303.1.8.1.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency. Comply with the 2013 California Building Code (CBC) Section 2303.2.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency in accordance with the 2013 California Building Code (CBC) Section 2303.2.1.

1. Where fire retardant treated wood is used the installation shall be observed / inspected by OSHPD field staff prior to painting, enclosing in construction or otherwise obscuring. The wood shall be factory treated and shall have at least one complete, visible stamp for OSHPD verification.
2. When required by, manufacturer's installation guidance, all cut edges shall be treated to maintain fire retardant rating. The manufactures guides shall be made available on the job site for review by OSHPD field personnel.

~~?. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.~~

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Roof framing and blocking.
3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Hem-fir; WCLIB, or WWPA.
2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
3. Western woods; WCLIB or WWPA.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

1. Special Purpose Nails: ScrewTite common spiral thread nails and concrete stub nails.

C. Power-Driven Fasteners: ~~ICC NER-272~~ICC ES ESR 2269.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Bolt and Lag Screw Connections: Make connections between members tight, accurate and square. Place fastenings without splitting wood; predrill as required. Install washers under each bolt and lag screw head and nut bearing on wood.

1. Drill bolt holes same size as bolt diameter.
2. Drill lag screw holes same size as thread root diameter; counterbore, same depth and diameter as shank. Turn lag screws into place; do not drive.
3. Tighten bolts and lag screws at installation; carefully retighten just prior to enclosing or at completion of project.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Provide blocking, nailers, and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in the 2013 California Building Code.

I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

1. Bolt blocking and nailer strips to metal, masonry, and concrete substrates.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Architectural wood cabinets and cabinetry including counters and telephone counter.
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal bracing, blocking, and backer plates required for installing woodwork.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Convene pre-installation conference one week prior to commencing work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. The first page of the original shop drawings shall bear an individually serial numbered Woodwork Institute Certified Compliance Label; www.woodworkinstitute.com.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
4. Corner pieces as follows:

    a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    b. Miter joints for standing trim.

5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of installation.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of wood-veneer faced cabinerts with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork.

D. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards," latest edition, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical architectural wood cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

2.2 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Type of Construction: Frameless.

C. Cabinet and Door and Drawer Front Interface Style: Flush overlay.

D. Reveal Dimension: As indicated.

E. Wood for Exposed Surfaces: As indicated.

F. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

G. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1.
2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency. Comply with the 2013 California Building Code (CBC) Section 2303.2.

1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.

3. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency in accordance with the 2013 California Building Code (CBC) Section 2303.2.1.

1. Where fire retardant treated wood is used the installation shall be observed / inspected by OSHPD field staff prior to painting, enclosing in construction or otherwise obscuring. The wood shall be factory treated and shall have at least one complete, visible stamp for OSHPD verification.
2. When required by, manufacturer's installation guidance, all cut edges shall be treated to maintain fire retardant rating. The manufactures guides shall be made available on the job site for review by OSHPD field personnel.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

1. Product: Blum Clip 170, Grass 3903, or comparable product as approved by the Architect.

C. Wire Pulls: Back mounted, solid brushed aluminum, 4 inches long, 5/16 inch in diameter.

1. Product: Amerock 9798, Epco 592, or comparable product as approved by the Architect.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

1. Product: Amerock 9798, Epco 592, or comparable product as approved by the Architect.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

1. Wall Mounted Products:

a. Standards: Knape & Vogt 87, heavy duty standards, or comparable product as approved by the Architect; satin chromium finish.
b. Brackets: Knape & Vogt 187, heavy duty brackets, or comparable product as approved by the Architect; satin chromium finish.
c. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

2. Built-In Products:

    a. Pilasters: Knape & Vogt 225 AL, or comparable product as approved by the Architect; aluminum finish, length as required.
    b. Supports: Knape & Vogt 226 PAL NAT, or comparable product as approved by the Architect; aluminum natural finish.
    c. Peg Supports: Knape & Vogt 346, or comparable product as approved by the Architect; satin chromium shelf support.
    d. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

F. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

    a. Product: Accuride 7432, full extension, 100 lb. capacity, or comparable product as approved by the Architect.

3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.

    a. Product: Accuride 3640, full extension, 200 lb. capacity, or comparable product as approved by the Architect.

6. For computer keyboard shelves, provide Grade 1HD-100.

    a. Product: Accuride standard keyboard system, Model CBERGO-Tray 200, or comparable product as approved by the Architect.

7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

H. Door Locks: BHMA A156.11, E07121; coordinate lock and keying requirements with Owner's Representative.

1. Hinged Door Product: CompX National C8173, C8174, C8175, surface locks with 3/4 inch travel, or comparable product as approved by the Architect.
2. Sliding Door Product: CompX National C8142, C8143, or comparable product as approved by the Architect.
3. Sliding Glass Door Product: CompX National C8140, or comparable product as approved by the Architect.

I. Drawer Locks: BHMA A156.11, E07041; coordinate lock and keying requirements with Owner's Representative.

1. Product: CompX National C8177, C8178, C8179, surface lock with 3/4 inch travel, or comparable product as approved by the Architect.

J. Door and Drawer Silencers: BHMA A156.16, L03011.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
3. Bright Brass, Vacuum Coated: BHMA 723 for brass base; BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
5. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
6. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
7. Satin Stainless Steel: BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors and elsewhere as required for corrosion resistance.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.8 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

C. Transparent Finish:

1. Staining: As indicated in Interior Design Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which Work will be applied, and verify the adequacy and location of required backing or support framing.

B. Verify dimensions where fabricated materials are required to conform to and fit adjacent building surfaces.

C. Correct unsuitable conditions before proceeding with installation.

3.2 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.3 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. In addition to requirements and recommendations in the Architectural Woodwork Standards for specified grade qualities, comply with the following:

1. Firmly secure all woodwork materials to previously prepared grounds; furring, framing and other backing.
2. Fit and scribe Work to adjacent materials in a manner so as not to injure either material.
3. When installing items not shop-assembled, distribute to best overall advantage the defects allowed in quality grade specified.
4. Leave finish Work smooth, evenly sanded, without tool marks, ready for finish coatings.

C. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

D. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
1. For shop finished items use filler matching finish of items being installed.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with fasteners, spacing, and methods indicated on Drawings in accordance with OSHPD approved attachment details.

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

I. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed architectural woodwork not indicated to be shop finished.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal bracing, blocking, and backer plates required for installing woodwork.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. The first page of the original shop drawings shall bear an individually serial numbered Woodwork Institute Certified Compliance Label; www.woodworkinstitute.com.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
4. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material.
2. Corner pieces as follows:

   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer andfabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of installation.

C. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards," latest edition, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Plastic Laminate: Provide materials with maximum flame spread Class and smoke density rating in accordance with ASTM E84 and the 2013 California Building Code (CBC) Section 803.1, Section 803.9, and Table 803.9.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles of Project site.

D. Type of Construction: Frameless.

E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

F. Reveal Dimension: As indicated.

G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

   1. For work in corridors and open nursing stations requiring Class A finishes, provide fire-rated high-pressure decorative laminate materials conforming to Class A flame spread and smoke developed ratings.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Abet Laminati, Inc.
      b. Formica Corporation.
      c. Lamin-Art, Inc.
      d. Panolam Industries International, Inc.
      e. Wilsonart International; Div. of Premark International, Inc.

H. Laminate Cladding for Exposed Surfaces:

   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade HGS.

5. Pattern Direction: As indicated.

I. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

J. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Basis-of-Design Products: As specified in Interior Design Drawings for basis-of-design high-pressure decorative laminate manufacturer and product information, including colors and patterns. Provide high-pressure decorative laminate products listed there.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency. Comply with the 2013 California Building Code (CBC) Section 2303.2.

1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency acceptable to authorities having jurisdiction in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency in accordance with the 2013 California Building Code (CBC) Section 2303.2.1.

1. Where fire retardant treated wood is used the installation shall be observed / inspected by OSHPD field staff prior to painting, enclosing in construction or otherwise obscuring. The wood shall be factory treated and shall have at least one complete, visible stamp for OSHPD verification.
2. When required by, manufacturer's installation guidance, all cut edges shall be treated to maintain fire retardant rating. The manufactures guides shall be made available on the job site for review by OSHPD field personnel.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

1. Product: Blum Clip 170, Grass 3903, or comparable product as approved by the Architect.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

1. Product: Amerock 9798, Epco 592, or comparable product as approved by the Architect.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

1. Product: Amerock 9798, Epco 592, or comparable product as approved by the Architect.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

1. Wall Mounted Products:

a. Standards: Knape & Vogt 87, heavy duty standards, or comparable product as approved by the Architect; satin chromium finish.
b. Brackets: Knape & Vogt 187, heavy duty brackets, or comparable product as approved by the Architect; satin chromium finish.
c. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

2. Built-In Products:

a. Pilasters: Knape & Vogt 225 AL, or comparable product as approved by the Architect; aluminum finish, length as required.
b. Supports: Knape & Vogt 226 PAL NAT, or comparable product as approved by the Architect; aluminum natural finish.
c. Peg Supports: Knape & Vogt 346, or comparable product as approved by the Architect; satin chromium shelf support.
d. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

F. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

a. Product: Accuride 7432, full extension, 100 lb. capacity, or comparable product as approved by the Architect.

3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.

a. Product: Accuride 3640, full extension, 200 lb. capacity, or comparable product as approved by the Architect.

6. For computer keyboard shelves, provide Grade 1HD-100.

a. Product: Accuride standard keyboard system, Model CBERGO-Tray 200, or comparable product as approved by the Architect.

7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

G. Door Locks: BHMA A156.11, E07121; coordinate lock and keying requirements with Owner's Representative.

1. Hinged Door Product: CompX National C8173, C8174, C8175, surface locks with 3/4 inch travel, or comparable product as approved by the Architect.
2. Sliding Door Product: CompX National C8142, C8143, or comparable product as approved by the Architect.
3. Sliding Glass Door Product: CompX National C8140, or comparable product as approved by the Architect.

H. Drawer Locks: BHMA A156.11, E07041; coordinate lock and keying requirements with Owner's Representative.

1. Product: CompX National C8177, C8178, C8179, surface lock with 3/4 inch travel, or comparable product as approved by the Architect.

I. Door and Drawer Silencers: BHMA A156.16, L03011.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
3. Bright Brass, Vacuum Coated: BHMA 723 for brass base; BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
5. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
6. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
7. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors elsewhere as required for corrosion resistance.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated. Cabinet design is indicated with AWS Casework Design Series (CDS) numbers on the Drawings. Provide stiffeners for tall and narrow doors to prevent warping.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Furnish anchorage products attached to or delivered with fabricated products. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which Work will be applied, and verify the adequacy and location of required backing or support framing.

B. Verify dimensions where fabricated materials are required to conform to and fit adjacent building surfaces.

C. Correct unsuitable conditions before proceeding with installation.

3.2 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.3 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. In addition to requirements and recommendations in the Architectural Woodwork Standards for specified grade qualities, comply with the following:

1. Firmly secure all woodwork materials to previously prepared grounds; furring, framing and other backing.
2. Fit and scribe Work to adjacent materials in a manner so as not to injure either material.
3. When installing items not shop-assembled, distribute to best overall advantage the defects allowed in quality grade specified.

C. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

D. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with toggle bolts through metal backing or metal framing behind wall finish fasteners, spacing, and methods indicated on Drawings in accordance with OSHPD approved attachment details.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Shop priming of wood trim.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for metal bracing, blocking, and backer plates required for installing woodwork.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including fire-retardant-treated materials.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with one-half of exposed surface finished.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

C. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards," latest edition, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Comply with such selections and requirements in addition to the quality standard including but not limited to joinery methods indicated on the Drawings.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical wood trim as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Premium.

B. Wood Species: Any closed-grain hardwood.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
2. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency acceptable to authorities having jurisdiction in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. For exterior applications, use materials that comply with testing requirements after being subjected to accelerated weathering according to ASTM D 2898.
2. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.
3. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
4. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
5. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

2.5 HARDWARE AND ACCESSORIES

A. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

1. Wall Mounted Products:

a. Standards: Knape & Vogt 87, heavy duty standards, or comparable product as approved by the Architect; satin chromium finish.
b. Brackets: Knape & Vogt 187, heavy duty brackets, or comparable product as approved by the Architect; satin chromium finish.
c. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

2. Built-In Products:

a. Pilasters: Knape & Vogt 225 AL, or comparable product as approved by the Architect; aluminum finish, length as required.
b. Supports: Knape & Vogt 226 PAL NAT, or comparable product as approved by the Architect; aluminum natural finish.
c. Peg Supports: Knape & Vogt 346, or comparable product as approved by the Architect; satin chromium shelf support.

3. Rubber Cushion: Knape & Vogt 129 Rub, or comparable product as approved by the Architect.

2.6 MISCELLANEOUS MATERIALS

A. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors and elsewhere as required for corrosion resistance..

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

D. Assemble casings in shop except where shipping limitations require field assembly.

E. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

2.8 SHOP PRIMING

A. Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099123 "Interior Painting."

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which Work will be applied, and verify the adequacy and location of required backing or support framing.

B. Verify dimensions where fabricated materials are required to conform to and fit adjacent building surfaces.

C. Correct unsuitable conditions before proceeding with installation.

3.2 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.3 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. In addition to requirements and recommendations in the Architectural Woodwork Standards for specified grade qualities, comply with the following:

1. Cut moldings and shapes sharp and true.
2. Construct built-up items with glued-up joints in addition to mechanical fasteners.

3. Avoid exposed nailing as far as possible; when necessary to nail, use blind nailing methods and set all nail heads.
4. Install running woodwork in single lengths whenever material is obtainable in required lengths; otherwise install in as long lengths as obtainable with joints between adjacent members staggered. Make joints only where solid fastening can be provided.
5. Cope molded Work at returns and interior angles. Miter at corners.
6. Kerf backs at wide flat members.
7. Firmly secure all woodwork materials to previously prepared grounds; furring, framing and other backing.
8. Fit and scribe Work to adjacent materials in a manner so as not to injure either material.
9. When installing items not shop-assembled, distribute to best overall advantage the defects allowed in quality grade specified.
10. Leave finish Work smooth, evenly sanded, without tool marks, ready for finish coatings.

C. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

D. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
1. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
1. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Refer to Section 099123 "Interior Painting" for final finishing of installed wood trim.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600

SECTION 064800 - WOOD FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Interior frames and jambs.
   2. Shop finishing wood frames and jambs.

B. Related Sections include the following:

   1. Section 092216 "Non-Structural Metal Framing" for metal bracing, blocking, and backer plates required for installing wood frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of productand finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

   1. Show details full size.
   2. Show locations and sizes of concealed blocking and reinforcement specified in other Sections.
   3. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

   1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of installation.

C. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards," latest edition, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood frames until operations that could damage wood frames have been completed in installation areas. If wood frames must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood frames until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where wood frames are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support wood frames by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood frames can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD FRAMES, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood frames indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated in Interior Design Drawings.

C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood frame and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood frame and quality grade specified unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Interior Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.5 FABRICATION

A. Fabricate wood frames to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

2.6 SHOP FINISHING

A. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood frames, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood frames. Apply two coats to end-grain surfaces.

B. Transparent Finish for Interior Frames:

1. Grade: Premium.
2. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which Work will be applied, and verify the adequacy and location of required backing or support framing.

B. Verify dimensions where fabricated materials are required to conform to and fit adjacent building surfaces.

C. Correct unsuitable conditions before proceeding with installation.

3.2 PREPARATION

A. Before installation, condition wood frames to average prevailing humidity conditions in installation areas.

B. Before installing wood frames, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.3 INSTALLATION

A. Grade: Install wood frames to comply with same grade as item to be installed.

B. Assemble wood frames and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood frames level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut wood frames to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor wood frames to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

F. Touch up finishing work specified in this Section after installation of wood frames. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

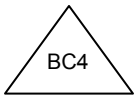
G. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed wood frames not indicated to be shop finished.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective wood frames, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood frames. Adjust joinery for uniform appearance.

B. Clean wood frames on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064800



SECTION 070150.19 - PREPARATION FOR REROOFING
(This Section has been revised in its entirety in OSHPD BC4)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Partial tear-off of roof areas indicated.
2. Removal of base flashings.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 011000 "Summary" for restrictions on use of the premises due to Owner or tenant occupancy.
3. Section 013200 "Construction Progress Documentation" for photographs taken before reroofing preparation.
4. Section 013233 "Photographic Documentation" for photographs taken before reroofing preparation.
5. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.
6. Section 017300 "Execution" for cutting and patching procedures for reroofing preparation.
7. Section 075216" Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" for roofing membrane, base flashings, roof insulation, and roofing accessories.
8. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
9. Division 23 Sections for HVAC equipment removal and reinstallation.
10. Division 26 Sections for electrical equipment disconnection and reconnection.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

B. Partial Roof Tear-Off: Removal of selected components and accessories from existing roofing system.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and details.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Include certificate that Installer is approved by warrantor of existing roofing system.
2. Include certificate that Installer is licensed to perform asbestos abatement.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 FIELD CONDITIONS

A. Existing Roofing System: SBS-modified bituminous roofing.

B. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations are not disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Owner assumes no responsibility for condition of areas to be reroofed.

F. Conditions existing at time of inspection for bidding are maintained by Owner as far as practical.

G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

1. Remove only as much roofing in one day as can be made watertight in the same day.
2. Respond immediately to correct roof leakage during reroofing preparation within a 4-hour time limit from time of notification of emergency conditions.
3. In the event of water penetration, provide for protection and repair of the building structure, interior and contents. Upon Contractor's unavailability or failure to provide this protection, Owner will take emergency action and make repairs. Contractor shall be responsible for costs of damages and repairs.

H. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work. Existing roof will be left no less watertight than before removal.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.9 SCHEDULING

A. Schedule work to coincide with commencement of installation of new roofing system.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

A. Use infill materials matching existing membrane roofing system materials, unless otherwise indicated.

2.2 INFILL AND REPLACEMENT MATERIALS

A. Use infill materials matching existing roofing system materials unless otherwise indicated.

1. Infill materials are specified in Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" unless otherwise indicated.

2.3 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

B. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approvals' "Approval Guide."

C. Metal Flashing Sheet: Metal flashing sheet is specified in Section 076200 "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions, including opening locations and dimensions, and roof dimensions.

B. Verify that existing roof surface is clear and ready for work of this Section.

3.2 PREPARATION

A. Shut off rooftop utilities and service piping before beginning the Work.

B. Test existing roof drains to verify that they are not blocked or restricted. Immediately notify Architect of any blockages or restrictions.

C. Protect existing roofing system that is not to be reroofed.

1. Limit traffic and material storage to areas of existing roofing that have been protected.

2. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.

D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

F. Verify that rooftop utilities and service piping have been shut off before commencing Work.

3.3 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

B. Partial Roof Tear-Off: Where indicated, remove existing roofing and immediately check for presence of moisture by visually observing substrate that is to remain.

1. Coordinate with Owner's inspector to schedule times for tests and inspections immediately after removal.
2. Remove wet or damp materials below existing roofing and above deck.
3. Inspect wood blocking, curbs, and nailers for deterioration and damage. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
4. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen, unadhered felts, and wet felts.
5. Remove fasteners from deck or cut fasteners off slightly above deck surface.

C. Night Seal: Provide temporary night tie-off at the end of each day's work or when rain is forecast to prevent the entry of moisture.

3.4 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.

C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

D. Provide additional deck securement as indicated on Drawings.

3.5 INFILL MATERIALS INSTALLATION

A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.

1. Installation of infill materials is specified in Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing."

B. Install new roofing patch over roof infill area. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.6 BASE FLASHING REMOVAL

A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 "Sheet Metal Flashing and Trim" and as indicated on Drawings

3.7 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket.
2. Mineral-wool blanket.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
2. Section 220719 "Plumbing Piping Insulation" for insulation of piping.
3. Section 230713 "Duct Insulation" for insulation of ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Deliver materials to Project Site in manufacturer's original packaging. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Immediately remove damaged material from Project Site.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET

A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

B. Glass-Fiber Blanket, Unfaced : ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Guardian Building Products, Inc.
c. Johns Manville; a Berkshire Hathaway company.
d. Knauf Insulation.
e. Owens Corning.

2.2 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Roxul Inc.; AFB or or other comparable product which allows the wall assembly to meet the STC rating indicated on the Drawings.

~~2.2~~2.3 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGM Industries, Inc.
b. Gemco.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

2.32.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-retardant, reinforced-polyethylene vapor retarders.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT, REINFORCED-POLYETHYLENE VAPOR RETARDERS

A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft., with maximum permeance rating of 0.1 perm.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Raven Industries Inc.
b. Reef Industries, Inc.

2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 200, respectively, per ASTM E 84.

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 072619 - MOISTURE MITIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a two-coat, 100 percent solids epoxy topping with a hydraulic cement self-leveling underlayment.

B. Related Sections include the following:

1. Division 09 Sections for finish flooring requiring moisture mitigation.

1.3 REFERENCES

A. ASTM F2170 - Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

C. ASTM C1583 - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension.

D. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

E. E. ASTM D1308 - Chemical Resistance of Finishes.

F. ASTM F3010 – 13 – Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Test Results: Moisture Vapor Emission Test Data.

C. Manufacturer Pre-Installation Checklist: For warranty requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Warranty: Copy of warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of moisture vapor mitigation system required for this Project.

B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.

C. Mockups: Apply underlayment mockups to demonstrate surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Apply mockups approximately 100 sq. ft. in area in location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Manufacturer: Certified applicator must file a pre-installation checklist with the manufacturer and receive written confirmation of the approval to proceed in order to obtain the extended 15-year warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original unopened packages or containers, with manufacturer's label intact and legible.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, sunlight, extreme temperatures, or other detrimental effects.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Do not install material below 50° F (10° C) surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section.
2. Refer to manufacturer's installation instructions for warm weather conditions.

PART 2 - PRODUCTS

2.1 TOPICAL MOISTURE MITIGATION SYSTEM

A. Two-Coat Moisture Control System for Concrete:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Engineered Cements ; ARDEX MC ULTRA or a comparable product as approved by the Architect from the following:

   a. Koster American Corporation; KOSTER VAP I 2000.
   b. Sinak; VECT-R System.

2. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:

   a. Application: Roller
   b. Material Requirements on CSP 3 Prepared Concrete:

      1) Max 170 sq. ft. per mixed unit of ARDEX MC ULTRA PRIMER.
      2) Max 100 sq. ft. per mixed unit of ARDEX MC ULTRA SEALER.

   c. Permeability: 0.02 perms, ASTM E96
   d. 14 pH solution: No effect, ASTM D1308
   e. Working Time: 30 minutes
   f. Pot Life: 30 minutes
   g. VOC: 0g/l, calculated SCAQMD 1113

2.2 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement-based Self-Leveling Underlayment.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Engineered Cements ; ARDEX V1200 or a comparable product as approved by the Architect from the following:

   a. Koster American Corporation; Koster SL, SL Premium, or SC.
   b. Sinak; Interlock.

2. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:

   a. Application: Barrel Mix or Pump
   b. Flow Time: 10 minutes
   c. Initial Set: Approx. 30 minutes
   d. Final Set: Approx. 60 minutes
   e. Compressive Strength: Minimum 4000 psi at 28 days, ASTM C109M.
   f. Flexural Strength: 1000 psi at 28 days, ASTM C78.
   g. VOC: 0 g/l, calculated SCAQMD 1113

B. Water: Potable and at a temperature of not more than 70 deg F.

C. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before application.
2. Mechanical preparation of the surface is required to obtain a minimum ICRI concrete surface profile of 3 (CSP 3). This substrate preparation must be by mechanical means, such as shot blasting.
3. The concrete must have a minimum tensile strength of at least 200 psi when tested in accordance with ASTM C1583. The concrete surface can be damp, but must be free of standing water.
4. Prior to beginning the installation, measure the relative humidity within the concrete (ASTM F2170). For these relative humidity methods, the RH shall not exceed 98%.
5. If the concrete substrate is too uneven to provide a uniform film thickness of the ARDEX MC ULTRA (typically CSP 6 or higher), the substrate can be pre-smoothed using ARDEX K 301 Self-Leveling Exterior Concrete Topping or ARDEX MRP Moisture Resistant Patch.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Mixing: Comply with manufacturer's printed instructions and the following.

1. Each individual unit of ARDEX MC ULTRA PRIMER AND ARDEX MC SEALER contains separate, premeasured quantities of the hardener (Part A) and the resin (Part B). The hardening agent (Part A) is added to the resin (Part B).
2. After opening each container, stir the individual components thoroughly before blending. The hardening agent (Part B) is added to the resin (Part A). Pour all of the hardener into the resin portion and stir thoroughly for a minimum of 3 minutes using a low speed drill and an epoxy mixing paddle. Once mixed, pour some of the epoxy back into the hardener container, stir for 10 seconds, and then pour all of the contents back into the resin container. Mix for an additional 30 seconds before applying.

C. Application: Comply with manufacturer's printed instructions and the following.

1. Apply the first coat of freshly mixed ARDEX MC ULTRA PRIMER (yellow) to the prepared concrete surface in a uniform direction at an application rate of up to 170 sq. ft. per unit to achieve a coating thickness of 9 - 10 mils. Use a short-nap paint roller or notched squeegee for smoother surfaces, and a longer nap roller for more uneven substrates. ARDEX MC ULTRA PRIMER can also be applied with a paintbrush for hard to reach areas and in corners.
2. While the first coat is still in a fresh state (maximum 30 minutes), broadcast an excess of fine sand that is less than 1/50 of an inch in gran size (98.5% passing sieve size #35 or #30) consistently over the entire area. Avoid standing or walking on the freshly applied sealer when broadcasting the sand. Allow this coat to dry for a minimum of 6 hours at 70°F before applying the sealer coat.
3. Once an area has been completely covered with sand, the surface of the sand can be lightly walked on being careful not to expose the sealer at any time. Use about 1lb. of sand per square foot of area. Once the sand broadcasting process is complete, avoid all additional traffic over the surface for a minimum of 6 hours.
4. Working in a direction that is 90° angle to direction that the first coat was applied, apply the sealer coat of ARDEX MC ULTRA SEALER (green) at a coverage rate of 100 sq. ft. per unit (14 - 16 mils).
5. While this second coat is still in a fresh state (maximum 30 minutes), broadcast an excess of fine sand that is less than 1/50 of an inch in grain size (98.5% passing sieve size #35 or #30) consistently over the entire area. Avoid standing or walking on the freshly applied sealer when broadcasting the sand.

6. Once an area has been completely covered with sand, the surface of the sand can be walked on being careful not to expose the sealer at any time. Use about 1lb. of sand per square foot of area. Once the sanding process is complete, avoid all additional traffic over the surface for a minimum of 16 hours.
7. After 16 hours, broom sweep and vacuum the surface to remove all loose sand. Protect this surface from construction traffic and dirt and debris using Masonite or similar until the ARDEX or topping is installed.

D. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.
3. Allowable Tolerance: Maximum deviation from a true plane of 1/4 inch as measured from the line of a 10 foot straightedge placed at any location on the surface. Tolerance shall be non-cumulative.

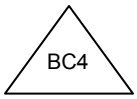
E. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

F. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 072619



SECTION 075216 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
2. Roof insulation.

B. Related Requirements:

1. Section 070150.19 "Preparation for Reroofing" for installing new roof over an existing deck.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Equipment on roof, coordinated with equipment installation drawings, showing required access points on equipment.
6. Walkways to required access points on equipment.

C. Samples for Verification: For the following products:

1. Cap sheet, of color required.
2. Flashing sheet, of color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of membrane roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of membrane roofing system, from ICC-ES.

E. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed FM Global approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Testing and Inspecting Agency: Perform work under the full-time observation of National Roofing Consultants, Inc. (NRC), 118 Lincoln Avenue, Pomona, CA 91767 (909) 620-0177, FAX (909) 620-6068, www.nrcroof.com. NRC will conduct testing indicated and prepare test reports, as documented according to ASTM E 548.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 MANUFACTURER'S OBSERVATIONS

A. When the project is in progress, the Roofing System Manufacturer shall provide the following:

1. Keep Architect informed as to the progress and quality the work as observed.
2. Provide job site observations a minimum of three days a week.
3. Report to the Architect in writing, any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
4. Confirm, after completion of the project and based on manufacturer's observations and tests, that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.11 FIELD CONDITIONS

A. Do not apply roofing membrane during inclement weather or when a 40 percent chance of precipitation is expected.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.12 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity.

B. All work shall be fully completed on each day. Phased construction will not be accepted.

1.13 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, fasteners, roofing accessories, and other components of roofing system.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corp, Roofing Systems MBR Cold Application Adhesive, or comparable product by one of the following and compatible with the existing roofing to remain:

1. Bitec, Inc.

2. CertainTeed Corporation.
3. Consolidated Fiber Glass Products Co.
4. Danoza Caribbean Inc.
5. Ecology Commercial and Industrial Roofing Systems.
6. Firestone Building Products.
7. GAF Materials Corporation.
8. Henry Company.
9. IKO.
10. Koppers Inc.
11. Malarkey Roofing Company.
12. MBTechnology.
13. Polyglass USA, Inc.
14. Siplast, Inc.
15. Soprema, Inc.
16. Tamko Building Products, Inc.
17. Tremco Incorporated.

B. Source Limitations: Obtain components including for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

1. Corner Uplift Pressure: As indicated on Drawings.
2. Perimeter Uplift Pressure: As indicated on Drawings.
3. Field-of-Roof Uplift Pressure: As indicated on Drawings.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING SHEET MATERIALS

A. Base Sheet:. ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers), dusted with fine mineral surfacing on both sides.

B. Granule-Surfaced Roofing Cap Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) ; granule surfaced; suitable for application method specified, and as follows:

1. Granule Color: White.

2.4 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric)] smooth surfaced; suitable for application method specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corp, Roofing Systems Group DynaBase.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corp, Roofing Systems Group MBR Cold Application Adhesive.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

D. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing.

E. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Corp, Roofing Systems Group Flat and Tapered Enrgy 3, or comparable product by one of the following:

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.
c. Dyplast Products.
d. Firestone Building Products.
e. GAF Materials Corporation.
f. Hunter Panels.
g. Insulfoam LLC; a Carlisle company.
h. Rmax, Inc.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.

C. Insulation Cant Strips: ASTM C 728, perlite insulation board.

D. Wood Nailer Strips: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."

E. Walkway Cap-Sheet Strips: ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers); granule surfaced; suitable for application method specified, and as follows:

F. Granule Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Comply with roofing system manufacturer's written instructions.

3.4 INSULATION INSTALLATION

A. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.

B. Install tapered insulation under area of roofing to conform to slopes indicated.

C. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

B. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:

1. Deck Type: C (concrete or non-nailable).
2. Adhering Method: L (cold-applied adhesive).
3. Number of Glass-Fiber Base-Ply Sheets: One.
4. Number of SBS-Modified Asphalt Sheets: One.
5. Surfacing Type: M (mineral-granule-surfaced cap sheet).

C. Start installation of roofing in presence of manufacturer's technical personnel.

D. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

1. Backnail roofing sheets to nailer strips according to roofing system manufacturer's written instructions.

E. Cooperate with manufacturer and testing and inspecting agencies engaged or required to perform services for installing roofing system.

F. Insurance/Code Compliance: Where required, install and test the roofing system to comply with governing regulations and specified insurance requirements.

G. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Keep roofing materials dry before and during application.
2. Do not permit phased construction.
3. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
4. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
5. Remove and discard temporary seals before beginning work on adjoining roofing.

H. Protect other work from spillage of roofing materials, and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installations of the roofing system.

I. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 BASE-SHEET INSTALLATION

A. Install lapped base-sheet course, lapping edges 8 inches (203 mm), and extending sheet over and terminating beyond cants 2 inches (51 mm) minimum. Stagger end laps 12 inches (305 mm). Install base flashing ply to all perimeter and projections details. Attach base sheet as follows:

3.7 BASE-PLY SHEET INSTALLATION

A. Install glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Extend sheets over and terminate beyond cants.

3.8 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Adhere to substrate in cold-applied adhesive.
2. Unroll roofing sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing sheets so side and end laps shed water.

D. Installing Roofing Membrane Sheets With Surface-Mounted Counterflashing/Coping Cap:

1. Flashing Height: 8 inch (203 mm) minimum, 24 inch (610 mm) maximum. Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in Flashing Bond Mastic. Run all field plies over cant a minimum of 2 inches (51 mm).
3. Install base flashing ply covering wall, with 6 inches (152 mm) on to the field of roof set in Flashing Bond Mastic.
4. The second ply shall be a modified flashing ply installed over the base flashing ply, 9 inches (229 mm) on to field of roof in Flashing Bond Mastic. All vertical seams shall receive a three course application of mastic and mesh allowed to cure and aluminize.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall.
6. Secure counterflashing set on a butyl tape above flashing 8 inches (203 mm) o.c., calk top of counterflashing.
7. Attach tapered board to top of wall. (minimum slope 1/4 inch in 12 inches (1:48)).
8. Cover tapered board and all exposed wood with base flashing ply fasten inside and out 8 inches (203 mm) o.c.
9. Install continuous cleat fasten 6 inches (152 mm) o.c.to outside wall.

10. Install new metal coping cap hooked to continuous cleat.
11. Fasten inside of cap 24 inches (610 mm) o.c.with approved fasteners with neoprene washers.

E. Installing Roofing Membrane Sheets With Surface-Mounted Counterflashing:

1. Flashing Height: 8 inch (203 mm) minimum, 24 inch (610 mm) maximum. Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in Flashing Bond Mastic. Run all field plies over cant a minimum of 2 inches (51 mm).
3. Install base flashing ply covering wall, with 6 inches (152 mm) on to the field of roof set in Flashing Bond Mastic.
4. The second ply shall be a modified flashing ply installed over the base flashing ply, 9 inches (229 mm) on to field of roof in Flashing Bond Mastic. All vertical seams shall receive a three course application of mastic and mesh allowed to cure and aluminize.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall.
6. Secure counterflashing set on a butyl tape above flashing 8 inches (203 mm) o.c., calk top of counterflashing.

F. Installing Roofing Membrane Sheets With Equipment Support:

1. Minimum curb height is 8 inches (203 mm). Prime vertical curb at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in Flashing Bond Mastic. Run all field plies over cant a minimum of 2 inches (51 mm).
3. Install base flashing ply covering curb, with 6 inches (152 mm) on to field of roof set in Flashing Bond Mastic.
4. The second ply shall be a modified flashing ply installed over the base flashing ply, 9 inches (229 mm) on to field of roof in Flashing Bond Mastic. All vertical seams shall receive a three course application of mastic and mesh allowed to cure and aluminize.
5. Install premanufactured cover. Fasten sides 24 inches (610 mm) o.c.with fasteners and neoprene washers. All joint cover laps shall have a butyl tape in-between metal covers.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

G. Installing Roofing Membrane Sheets With Curb Detail/Air Handling Station:

1. Minimum curb height is 8 inches (203 mm). Prime vertical curb at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in Flashing Bond Mastic. Run all field plies over cant a minimum of 2 inches (51 mm).
3. Install base flashing ply covering curb, with 6 inches (152 mm) on to field of roof set in Flashing Bond Mastic.
4. The second ply shall be a modified flashing ply installed over the base flashing ply, 9 inches (229 mm) on to field of roof in Flashing Bond Mastic. All vertical seams shall receive a three course application of mastic and mesh allowed to cure and aluminize.
5. Install prefabricated counterflashing with fasteners and neoprene washers.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

3.9 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Seal all curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. No condition should exist that could permit moisture entering behind, around, or under the roof or flashing membrane.
2. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of 100 square feet per gal. Allow primer to dry tack free.
3. Prime substrates with asphalt primer if required by roofing system manufacturer.
4. Backer-Sheet Application: Adhere backer sheet to substrate in cold-applied adhesive.
5. Flashing-Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

3.10 Roof Drains: Set > metal flashing of dimensions to match existing roof drain sumps in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping, and extend a minimum of 4 inches (100 mm) [6 inches (150 mm)] beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

3.11 Install stripping according to roofing system manufacturer's written instructions.

3.12 WALKWAY INSTALLATION

A. Walkway Cap-Sheet Strips: Install walkway cap-sheet strips over roofing membrane, using same application method as used for roofing cap sheet

3.13 FIELD QUALITY CONTROL

A. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. At option of NRC, take 12 inch (305 mm) square or 4 by 36 inch cuts.
2. Determine approximate quantities of components within roofing membrane according to ASTM D 3617, unless indicated otherwise by NRC.

3. Examine test specimens for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
4. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

C. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

D. Notify the Architect upon completion of corrections.

E. Following the final inspection, acceptance shall be made in writing by the material manufacturer.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. Keep traffic and equipment off completed roofing. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Remove drippage of bitumen adhesive from walls, windows, floors, ladders, and finished surfaces.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

E. Clean roof membrane, flashing surfaces, gutters, and downspouts of debris.

3.15 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.

6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <**Insert** mph>;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075216

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.
2. Formed equipment support flashing.

B. Related Requirements:

1. Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" for materials and installation of sheet metal flashing and trim integral with roofing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Embossed.

2. Exposed Coil-Coated Finish:

    a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
    b. Grace Construction Products; W. R. Grace & Co.-Conn.; Ultra.
    c. |Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
    d. Polyguard Products, Inc.; Deck Guard HT.
    e. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
    f. SDP Advanced Polymer Products Inc; Palisade SA-HT.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

F. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

H. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

J. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

K. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

B. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or SMACNA.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM).

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for fire-safing insulation.
2. Section 078413 "Penetration Firestopping" for fire-resistance-rated firestopping systems.
3. Section 078446 "Fire-Resistive Joint Systems" for fire-resistance-rated joint systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.
2. Review and finalize construction schedule and verify sequencing and coordination requirements.
3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
4. Review surface conditions and preparations.
5. Review field quality-control testing procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Locations and types of surface preparations required before applying SFRM.
2. Extent of fireproofing for each construction and fire-resistance rating.
3. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
4. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
5. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects to set quality standards for materials and execution for preconstruction testing.

1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing and inspecting agency engaged by Contractor or manufacturer to perform preconstruction testing on field mockups of fireproofing.

1. Provide test specimens and assemblies representative of proposed materials and construction.
2. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

4. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

B. Preconstruction Adhesion and Compatibility Testing: Test and inspect for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

1.10 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and applicationor conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Grace Construction Products; W.R. Grace & Co. -- Conn.
    b. Isolatek International.
    c. Schundler Company (The); Classic 5 LD.

2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
5. Combustion Characteristics: ASTM E 136.
6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 10 or less.
    b. Smoke-Developed Index: 10 or less.

7. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International.

H. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Carboline Company; an RPM International company; Hardcoat 4500.
2) Isolatek International, Inc.; Fendolite TG.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

C. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written recommendations.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the 2013 CBC, Section 1705A.13.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

3.6 FIREPROOFING SCHEDULE FOR OSHPD PROJECTS

A. Jurisdiction:

1. California Office of Statewide Health Planning and Development.

B. Referenced Standards and Fire-Rating Classifications.

1. ANSI/UL 263 - Fire Tests of Building Construction and Materials; UL Fire Resistance Ratings.
2. UL Fire Resistance Directory; Vol. 1, latest edition.

C. Fire Resistive Requirements for Type I Construction:

1. Structural Frame:
   Primary Beams and Columns — 3hr (a) (b)

2. Floor/Ceiling Assemblies and
   Secondary Members — 2hr (b)

3. Roof/Ceiling Assemblies and
   Secondary Members — 2hr (b)

D. Provide continuous inspection of fireproofing. Provide fireproofing thicknesses in accordance with the California Building Code, latest edition as adopted by OSHPD, and in compliance with the UL Design Numbers listed below:

1. Steel Columns - Wide Flange Shapes: UL Isolatek #X790 or Grace #X772.

Minimum Col. Size	3 hr Rating Thickness (c)	4 hr Rating Thickness (d)
W6x9	2-1/8"	2-11/16"

W6x16	1-7/8"	2-3/8"
W8x28	1-13/16"	2-5/16"
W10x49	1-5/8"	2-1/8"
W14x228	7/8"	1-3/16"
W14x730	3/8"	1/2"

2. Steel Columns - Pipe and Tube Shapes: UL Design Grace #X771 or Isolatek #X790. Thickness of fireproofing is calculated by using the design formula in the UL Directory.
3. Protected Floor/Ceiling Assembly and Protected Roof/Ceiling Assembly when used with Metal Deck and NW or LW Stuctural Concrete Fill: UL Design Grace #D779 and #N779 or Isolatek #D759 and #N759.

Rating	Concrete (e)	PCF	Beam (f)(g)	Deck
2hr (c)	NW or LW	150	13/16"	3/8"
3hr (h)	NW or LW	150	1-5/16"	13/16"

4. Unprotected Floor/Ceiling Assembly and Unprotected Roof/Ceiling Assembly when used with Metal Deck and Structural Concrete Fill: UL Design Grace #N782 or Isolatek #N759.

Rating	Concrete (e)	Beam (f)
2hr (c)	NW or LW (j)	1-1/16"
3hr	NW or LW (k)	1-1/16"

5. Protected Roof/Ceiling Assembly when used with Rigid Insulation on Metal Deck: UL Design Grace #P732 or Isolatek #P719.

Rating	Concrete	Deck	Beam (e)(m)(q)
2hr	none	1-9/16"	13/16"

6. Unprotected Roof/Ceiling Assembly when used with Insulating Concrete and Rigid Board Insulation: UL Design Grace #P936 and #S736 or Isolatek #P922 and #S729.

Rating	Concrete	Beam (o)(p)(q)
2hr	Vermiculite	1-1/16"

FOOTNOTES:

(a) Fireproofing of structural frame components within the exterior wall shall not be less than the fire rating required for the wall.

(b) Fireproofing of structural frame components above the roof assembly may be unprotected, non-combustible construction without fireproofing for mechanical rooms conforming to Sec. 3601(D) exception 3 when the room does not exceed 1/3 of the roof area and is 20 feet or more from adjacent property line and when the mechanical penthouse houses only mechanical equipment.

(c) Typical U.O.N.

(d) 4hr columns required within 4 hr. rated walls as occurs, as indicated on Drawings.

(e) Minimum concrete thickness above flutes is 2-1/2".

(f) Minimum beam size is W8 x 28.

(g) When deck is all-fluted use 11/16" an 1-1/16" for 2 and 3 hr ratings respectively.

(h) For occupancy separations as occurs, as indicated on Drawings.

(i) Use UL Design No.N759 for 3 hr beam in a 2 hr protected assembly.

(j) Minimum thickness of concrete is 3-1/4" for LW and 4-1/2" for NW concrete. For 2 hr deck.

(k) Minimum thickness of concrete is 4-3/16" for LW and 5-1/4" for NW concrete. For 3 hr deck.

(l) Minimum beam size is W6 x 16.

(m) For 3 hr beams use UL Design #S721 and provide 1-1/4" thickness.

(n) Vermiculite concrete shall maintain 2" minimum thickness.

(o) Minimum beam size is 6 x 16 for 2 hr rating.

(p) For 3 hr beams use UL Design #S729 and provide 1-11/16" thickness for a minimum 6 x 16 beam.

(q) Thickness of fireproofing may be calculated by the "Adjustment of Sprayed Protection Material Thickness for Unrestrained Beam Ratings for Various Beam Sizes" method.

END OF SECTION 078100

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Sections:

1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 DEFINITIONS

A. Firestopping: A material or combination of materials, to retain the integrity of fire-resistance-rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases. Provide in specific locations as follows:

1. Duct cables, conduit, and piping penetrations through floor slab and through fire-resistance-rated walls or partitions.
2. Penetrations of vertical service shafts.
3. Openings and penetrations in fire-resistance-rated walls or partitions containing fire doors.
4. Along the top of fire-resistance-rated walls and partitions having a construction joint or deflection track.
5. Locations where specifically indicated on the Drawings or where specified in other sections of the Specifications.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show each condition requiring firestopping, indicating proposed UL Classified Systems material, reinforcement, anchorage, fastenings, and method of installation. Construction details shall accurately reflect actual job conditions.

1. Submit a copy of UL Classified illustration of each proposed system indicating manufacturer approved modifications.

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For qualified Installer.

E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm with a minimum of 2 years experience experience in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Code Requirements: Use materials meeting the requirements of NFPA 101, "Life Safety Code," and NFPA 70, "National Electrical Code."

D. OSHPD Requirements: Use materials and installation procedures approved for use by the OSHPD Fire Marshal.

E. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

F. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original unopened containers or packages bearing manufacturer's name, brand designations, and product description.

B. Store materials under cover and protect from damage. Do not use damaged materials.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by Hilti, Inc. or 3M Fire Protection Products.

~~A.~~B. Firestopping materials shall be the products of a single manufacturer.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. For insulated pipe, the fire-rating classification shall not require removal of the insulation.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls, smoke-barrier walls, and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include floor/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.

3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: In addition to penetration firestopping systems used, seal holes and voids in fire- rated construction with UL Classified intumescent material capable of expanding up to 10 times when exposed to temperatures beginning at 250 deg Fapproved ratings to 4 hours as required per ASTM E814.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated. Seal holes and voids made by penetrations to ensure an effective smoke barrier.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Install firestopping materials in floors having void openings of 4 inches or more that are capable of supporting the same required floor loads unless the filled area is protected from loading or traffic, or a steel plate cover designed to span opening is provided over the firestopping fill.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL Classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ. Provide joints indicated below or as shown on Drawings.

1. Construction conditions:

   a. C-AJ: Concrete wall or floors.
   b. F-A: Concrete floors.
   c. W-J: CMU wall assemblies.
   d. W-L: Framed wall assemblies.
   e. F-C: Framed floor assemblies.
   f. HW: Head of wall.

2. Verify minimum type of floor or wall construction required before using any system noted.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Grabber Construction Products.
d. Hilti, Inc.
e. Nelson Firestop; a brand of Emerson Industrial Automation.
f. NUCO Inc.
g. Passive Fire Protection Partners.
h. RectorSeal.
i. Specified Technologies, Inc.
j. Thermafiber, Inc.; an Owens Corning company.
k. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Hilti, Inc.
d. Nelson Firestop; a brand of Emerson Industrial Automation.
e. NUCO Inc.
f. Passive Fire Protection Partners.
g. RectorSeal.
h. Specified Technologies, Inc.
i. Thermafiber, Inc.; an Owens Corning company.
j. Tremco, Inc.

2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG. Provide joints indicated below or as shown on Drawings.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.

C. Wall-to-Wall, Joint Firestopping Systems:

1. Nominal Joint Width: As indicated.

D. Floor-to-Wall, Joint Firestopping Systems:

1. Nominal Joint Width: As indicated.

E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems:

1. Nominal Joint Width: As indicated.

F. Bottom-of-Wall, Joint Firestopping Systems:

1. Nominal Joint Width: As indicated.

G. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards:

1. Nominal Joint Width: As indicated.

H. Perimeter Joint Firestopping Systems:

1. Linear Opening Width: As indicated, maximum.

END OF SECTION 078443

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:

    a. Fire-resistive joint system products bear classification marking of qualified testing agency.
    b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:

        1) UL in its "Fire Resistance Directory."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
1. Joints include those installed in or between fire-resistance-rated floor or floor/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Trak Corp.
b. Grace Construction Products.
c. Hilti, Inc.
d. Specified Technologies Inc.
e. 3M Fire Protection Products.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Grace Construction Products.
b. Hilti, Inc.
c. Specified Technologies Inc.
d. 3M Fire Protection Products.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG. Provide joints indicated below or as shown on Drawings.

B. Head-of-Wall, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: HW-D-0025.
   2. UL-Classified Systems: HW-D-0104.
   3. UL-Classified Systems: HW-D-0502, -0503.

C. Bottom-of-Wall, Fire-Resistive Joint Systems:
   1. UL-Classified Systems: BW-S-0007.

END OF SECTION 078446

SECTION 079100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preformed, foam joint seals.
2. Precured, extruded-silicone joint seals.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for liquid sealants applied over preformed seals in dual seal systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each preformed joint seal product.

B. Samples for Verification: For each type and color of preformed joint seal required, provide Samples with joint seals in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint seals.

C. Preformed Joint Seal Schedule: Include the following information:

1. Joint seal location and designation.
2. Joint width and movement capability.
3. Joint seal manufacturer and product name.
4. Joint seal color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each preformed joint seal for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.

1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PREFORMED, FOAM JOINT SEALS

A. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
b. LymTal International, Inc.; Iso-Flex Hydroseal.
c. MM Systems Corporation; EIF.
d. Sandell Manufacturing Co., Inc.; Polyseal.
e. Schul International Company, Inc.; HydroStop.
f. Watson Bowman Acme Corporation; Wabo SeismicWeatherSeal.

2. Design Criteria:

a. Nominal Joint Width: As indicated on Drawings.
b. Movement Capability: As indicated on Drawings.

3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.2 EXTRUDED-SILICONE JOINT SEALS

A. Extruded-Silicone Joint Seals: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 123 Silicone Seal.
   b. GE Construction Sealants; UltraSpan US1100.
   c. May National Associates, Inc.; Bondaflex Silbridge 300.
   d. Pecora Corporation; Sil-Span.
   e. Sealex, Inc.; ImmerSeal.
   f. Tremco Incorporated; Spectrem Simple Seal.

2. Joint Seal Width: Joint size indicated on Drawings plus 0.75 inch.
3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Installation of Preformed, Foam Joint Seals:

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

C. Installation of Precured, Extruded-Silicone Joint Seals:

1. Apply masking tape to each side of joint, outside of area to be covered by seal system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone seal system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact with substrate.
4. Complete installation of seal system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.4 PROTECTION

A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for sealing joints in firestopping.
2. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
3. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
4. Section 088000 "Glazing" for glazing sealants.
5. Section 092900 "Gypsum Board" for sealing perimeter joints.
6. Section 093013 "Ceramic Tiling" for sealing tile joints.
7. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 795.
b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 295 FPS NB.
c. Pecora Corporation; 864NST.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Sonalastic TX1.
b. Pecora Corporation; Dynatrol I-XL.
c. Tremco Incorporated; Dymonic.
d. .

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Sonolastic SL 1.
b. Pecora Corporation; NR-201.
c. Polymeric Systems, Inc.; Flexiprene 952.
d. Schnee-Morehead, Inc.; an ITW company; Permathane SM7101.
e. Sherwin-Williams Company (The); Stampede 1SL.
f. .

C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. LymTal International, Inc.; Iso-Flex 888QC.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 786-M White.
b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
d. Soudal USA; RTV GP.
e. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Chem-Calk 300.
b. Pecora Corporation; BC-158.
c. .

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Sonolac.
b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil-A 700.
c. Pecora Corporation; AC-20.
d. .

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Construction Chemicals - Building Systems.
b. Construction Foam Products, a division of Nomaco, Inc.
c. .

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Tile control and expansion joints.
    b. Joints between different materials listed above.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Perimeter joints between materials listed above and frames of doorswindows and louvers.
    c. Control and expansion joints in ceilings.
    d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Isolation joints in cast-in-place concrete slabs.
    b. Control and expansion joints in tile flooring.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of wallsand partitions.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Acoustical-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
b. GE Construction Sealants; RCS20 Acoustical.
c. Grabber Construction Products; Acoustical Sealant GSC.
d. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
e. Pecora Corporation; AC-20 FTR.
f. Serious Energy Inc.; Quiet Seal Pro.
g. Tremco, Incorporated; Tremco Acoustical Sealant.
h. USG Corporation; SHEETROCK Acoustical Sealant.

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 099113 "Exterior Painting" 099123 "Interior Painting" for field painting hollow metal doors and frames.
3. Section 134900 "Radiation Protection" for lead-lined, hollow-metal doors and frames.
4. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule and make door hardware, frames and door submittals on same date.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically, in stacks of five units maximum; under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Do not store in a manner that traps excess humidity.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Commercial Door & Hardware Inc.
3. Curries Company; an Assa Abloy Group company.
4. Greensteel Industries, Ltd.
5. Republic Doors and Frames.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches.
    c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
    d. Edge Construction:Model 1, Full Flush.
    e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

    a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    c. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.

4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

D. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelite Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

    b. Compression Type: Not less than two anchors in each frame.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

6. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

E. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, Section 087100 “Door Hardware,” and templates.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
3. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or miteredhairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.

b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
4. Ceiling Struts: Extend struts vertically from top of frame at each jambaccording to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 099123 "Interior Painting" for field finishing of access doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.
f. Karp Associates, Inc.
g. Lane-Aire Manufacturing Corp.
h. Larsens Manufacturing Company.
i. Maxam Metal Products Limited.
j. Metropolitan Door Industries Corp.
k. MIFAB, Inc.
l. Milcor; Commercial Products Group of Hart & Cooley, Inc.
m. Nystrom, Inc.
n. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As indicated on Drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
6. Frame Material: Same material and thickness as door.
7. Latch and Lock: As indicated in schedule.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. JL Industries, Inc.; a division of the Activar Construction Products Group.
e. Karp Associates, Inc.
f. Maxam Metal Products Limited.
g. Metropolitan Door Industries Corp.
h. MIFAB, Inc.
i. Nystrom, Inc.
j. Williams Bros. Corporation of America (The).

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that indicated.
5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
7. Frame Material: Same material, thickness, and finish as door.

8. Latch and Lock: Self-closing, self-latching door hardware, as indicated in schedule.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Aluminum Extrusions: ASTM B 221, Alloy 6063.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.
3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

3.4 ACCESS DOOR SCHEDULE

A. Gypsum Board Walls and Ceilings: Milcor Model DW, Karp Model KDW, or equal.

B. Ceramic Tile: Milcor N\Model Ms, Karp Model DSC-214M-SS, or equal.

END OF SECTION 083113

SECTION 083213 - SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sliding aluminum-framed glass doors for exterior locations.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for joint sealants at frame perimeter between sliding doors and adjacent construction.
2. Section 087100 "Door Hardware" for hardware not specified in Section 083213.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: For sliding aluminum-framed glass doors.

1. Include plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.
3. Include hardware and required clearances.

C. Samples: For each exposed product and for each color specified, 12-inch-long section with weather stripping, glazing bead, and factory-applied color finish.

D. Product Schedule: For sliding aluminum-framed glass doors. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Regulatory Requirements: Conform to testing and performance requirements of Sections 1405.13 and 1710A.5 of the 2013 California Building Code (CBC).

1.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection.
c. Excessive water leakage or air infiltration.
d. Faulty operation of movable panels and hardware.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period:

a. Sliding Door: Three years from date of Substantial Completion.
b. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fleetwood Aluminum Products, Inc.; Series 1000 or a comparable product as approved by Architect by one of the following:

1. C. R. Laurence Co., Inc.
2. .

B. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Product Certification: AAMA certified with label attached to each door.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: Class AW.
2. Minimum Performance Grade: Grade 40.

C. Thermal Movements: Provide sliding aluminum-framed glass doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.

B. Threshold and Sill Cap/Track: Provide extruded-aluminum threshold and track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated; with manufacturer's standard finish.

1. Low-Profile Floor Track: ADA-ABA compliant.

2.4 GLAZING

A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. Comply with requirements indicated in Section 088000 "Glazing."

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with aluminum complying with AAMA 907 and designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.

B. Door Pulls: Provide manufacturer's standard pull.

1. Color and Finish: As selected by Architect from manufacturer's full range.

C. Lock: Install manufacturer's keyed cylinder lock and multipoint locking device on each movable panel, lockable from the inside and outside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

2.6 ACCESSORIES

A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

2.7 FABRICATION

A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding aluminum-framed glass door installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Lubricate hardware and moving parts.

B. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

C. Clean exposed surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

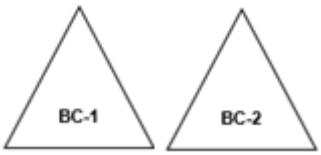
D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding aluminum-framed glass door surfaces, remove contaminants immediately according to manufacturer's written instructions.

F. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

G. Replace damaged components.

END OF SECTION 083213



SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware and power supplies.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Automatic Door Operators".
3. Division 13 Section "Radio Frequency Shielding".
4. Division 28 Section "Access Controls".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. CBC - California Building Code.
2. NFPA 80 - Fire Doors and Windows.
3. NFPA 105 - Installation of Smoke Door Assemblies.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.

2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80 and CBC requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Where indicated to comply with accessibility requirements, comply with California Building Code Chapter 11B Accessibility as follows:

    a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    b. Door Closers: Comply with the following maximum opening-force requirements indicated:

        1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
        2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction, not to exceed maximum 15 lbf.

    c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. California Building Code Chapter 10: Comply with the following for means of egress doors:

    a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for egress operation.

4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

    a. Test Pressure: Positive pressure labeling.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Management and Coordination." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Management and Coordination" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closers.
4. Twenty five years for continuous hinges.
5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Three Hinges: For doors with heights 61 to 90 inches.
b. Four Hinges: For doors with heights 91 to 120 inches.
c. For doors with heights more than 120 inches provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel or stainless steel, as scheduled, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

    a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

        1) Out-swinging exterior doors.
        2) Out-swinging access controlled doors.

5. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. McKinney Products (MK).

B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 certified pin and barrel continuous hinges with minimum 12 gauge (.105) Type 304 stainless steel hinge leaves, concealed teflon-coated stainless pin, and twin self-lubricated medical bearings at each knuckle separation. Fabricate hinges non-handed and U.L. listed for use on up to and including 3 hour rated doors. Provide hinges with power transfer cutouts where indicated at electrified openings.

1. Acceptable Manufacturers:

    a. Markar Products (MR).
    b. McKinney Products (MK).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

    a. Securitron (SU) - EL-CEPT Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood Manufacturing (RO).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Coordinators fabricated from steel with nylon-coated strike plates and built-in adjustable safety release.

1. Acceptable Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood Manufacturing (RO).

C. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

    a. Acceptable Manufacturers:

        1) Ives (IV).
        2) Rockwood Manufacturing (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Yale 6-Pin cylinders, complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Match Facility Restricted Keyway.

D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
2. Existing System: Grand master key locks to Owner's existing Yale GMK System.

E. Key Quantity: Provide the following minimum number of keys:

1. Top Master Key: One (1)
2. Change Keys per Cylinder: Two (2)
3. Master Keys (per Master Key Group): Two (2)
4. Grand Master Keys (per Grand Master Key Group): Two (2)
5. Construction Keys: Ten (10)

F. Construction Keying: Provide construction master keyed cylinders. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

G. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latch-bolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Mortise locks to be certified Security Grade 1 and include sectional type trim.
2. Acceptable Manufacturers:

   a. Yale (YA) – 8800FL Series.
   b. No Substitution – Facility Standard.

B. Lock Trim Design: As specified in Hardware Sets.

2.7 AUXILIARY LOCKS

A. Push-Pull Latches, Paddle Type, Cylindrical: ANSI/BHMA A156.2, Series 4000, Operational Grade 1 hospital type push-pull latches with ligature-resistant paddle trim capable of being mounted vertically, horizontally, or in mixed combinations. Non-handed units, standard 2 3/4" or 5" backsets available, and UL listed for all labeled metal or wood doors. Provide optional lead-lining and engraved cases or handles as specified in Hardware Sets.

1. Acceptable Manufacturers:

a. Rockwood (RO) – 596 Series.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip 7/8" LTC Strikes: For locks to be installed for use with doors equipped with overlapping astragals.
2. Extra-Long-Lip Strikes: For locks used on frames with applied trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
3. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the push-bar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is not acceptable except in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
    b. Where function of exit device requires a cylinder, provide a keyed cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

    1. Acceptable Manufacturers:

        a. Corbin Russwin Hardware (RU) - ED5000 Series.
        b. No Substitution – Facility Standard.

2.10 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES

A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

    1. Acceptable Manufacturers:

        a. Yale (YA) – Yale 7000 Series.

B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction, outside door trim control, exit alarm and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as 24VDC operating voltage.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped provide units complying with CBC Chapter 11B.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

    a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Covers: Provide PVC free closer covers with a painted finish to match other hardware on the project.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable back-check and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:

    a. Norton Door Controls (NO) - 7500 Series.

2.12 AUTOMATIC DOOR OPERATORS

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Electromechanical Door Operators: Self-contained units powered by permanent magnet DC motor, with closing speed controlled mechanically by gear train, connections for power, activation and safety device wiring, and manual operation including spring closing when power is off.

C. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

D. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:

a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

E. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

F. Operation: Power opening and spring closing operation capable of meeting CBC Chapter 11B accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

1. On-off switch to control power to be key switch operated.

G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, back-check, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

I. Activation Devices: Provide hands-free activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

J. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:

    a. Stainless Steel: 300 series, 050-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:

    a. Rockwood Manufacturing (RO).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

    a. Ives (IV).
    b. Rockwood Manufacturing (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

    a. Rixson Door Controls (RF).
    b. Rockwood Manufacturing (RO).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

    a. Securitron (SU) - DPS Series.
    b. GE Sentrol (GE) - 1076 Series.

B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

a. Securitron (SU) - BPS Series.

C. Hands-free Door Activator: Provide Hands-free door activator with short range infa-red sensor. Switches shall be single gang or double gang, with stainless steel or polycarbonate faceplate, as required. Units shall have an on-board LED for ease of setup, fail-safe or non-fail-safe selectable, with an adjustable minimum operating range of 2" and a maximum operating range of not more than 18", regardless of the reflective material placed within the sensor field. The switch shall have a relay contact rating of 5 amps @ 30 VDC and shall also be ROHS compliant. Switches mounted outdoors, or exposed to interior water / humidity shall be mounted with weather resistant integral rubber gasket and back box, supplied by the same manufacturer.
1. Acceptable Manufacturers:

a. Camden Door Controls (CA) – CM-325 Series.
b. "Wave to Open" with hand.
c. Stainless Steel faceplate.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated on drawings or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with CBC Chapter 11B Accessibility.
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Hardware Schedule

Set: 1.0
Description: Patient Toilet

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Cylindrical Lock (privacy lock)	PB 5425LN 495	626	YA
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
3	Silencer	608		RO

Set: 1.1
Description: Patient ADA TolietToilet

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock (privacy lock)	PBR 8862FL IND 2815	630	YA
1	Door Closer Plus	CPS7500 DA G SN-134	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
3	Silencer	608		RO

Set: 1.2
Description: Patient Toilet In-Swing (Rescue Hw)

1	Pivot Set	EP-5J	US26D	MK
1	Cylindrical Privacy Lock	PB 5425LN	626	YA
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Combination Stop/Strike	CSS-9X5-3/4 OH	US26D	MK

Set: 2.0
Description: ADA Toilet

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (privacy lock)	PBR 8862FL IND 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Mop Plate	K1050	US32D	RO
1	Door Stop	406	US32D	RO
1	Threshold	Per Detail		00
1	Silencer	608		RO

Set: 3.0
Description: Staff Toilet

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (privacy lock)	PBR 8862FL IND 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Mop Plate	K1050	US32D	RO
1	Door Stop	406	US32D	RO
1	Threshold	Per Detail		00
1	Gasketing	S88D		PE

Set: 3.1
Description: Staff Toilet

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (privacy lock)	AUR 8862FL IND 2815	630	YA

1	Door Closer	PR7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Wall Protector Stop	390-S	IVO	00
1	Threshold	Per Detail		00
1	Gasketing	S88D		PE

Set: 4.0
Description: Dress Room

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock (privacy lock)	PBR 8862FL IND 2815	630	YA
1	Concealed Overhead Stop	2-X36	630	RF
1	Kickplate	K1050 10" 4BE CSK	US32D	RO

Set: 4.1
Description: ADA Dress Room

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (privacy lock)	PBR 8862FL IND 2815	630	YA
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
3	Silencer	608		RO

Set: 5.0
Description: Ultrasound

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock (passage)	PBR 8801FL 2815	630	YA
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
3	Silencer	608		RO

Set: 6.0
Description: Work Room / Office / Control

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (entry)	PBR 8807FL GMK CMK 2815	630	YA
1	Door Closer	7500 G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE

Set: 6.1
Description: Corridor Control

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (entry)	PBR 8807FL GMK CMK 2815	630	YA
1	Door Closer	PR7500 G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Wall Protector Stop	390-S	IVO	00
1	Gasketing	S88D		PE

Set: 6.2
Description: Control

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock (entry)	PBR 8807FL GMK CMK 2815 LEAD LINED	630	YA
1	Door Closer Plus	CPS7500 DA G SN-134 LEAD LINED	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
3	Silencer	608		RO

Set: 7.0
Description: Stress / Echo

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (classroom)	PBR 8808FL GMK CMK 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE

Set: 7.1
Description: Hot Lab

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock	PBR 8808FL GMK CMK 2815	630	YA
1	Concealed Overhead Stop	2-X36	630	RF
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88D		PE

Set: 8.0
Description: Storage

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (storeroom)	PBR 8805FL GMK CMK 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Armor Plate	K1050 F >34" UL	US32D	RO
1	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE

Set: 8.1
Description: Soiled Work Room

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (storeroom)	PBR 8805FL GMK CMK 2815	630	YA
1	Door Closer	PR7500 DA G	689	NO
1	Armor Plate	K1050 F >34" UL	US32D	RO
1	Wall Protector Stop	390-S	IVO	00
1	Gasketing	S88D		PE

Set: 9.0
Description: Hskp / storage

3	Hinge	TA2314 4-1/2" x 4" @ Door 1B041	US32D	MK
3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK

1	Mortise Lock (storeroom)	PBR 8805FL GMK CMK 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Door Closer	PR7500 DA G @ Door 1B041	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Wall Protector Stop	390-S @ Door 1B041	IVO	00
1	Gasketing	S88D		PE

Set: 10.0
Description: Staff Lounge

3	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock	PBR 8808FL GMK CMK 2815	630	YA
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE

Set: 10.1
Description: Corridor Waiting

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock	PBR 8808FL GMK CMK 2815	630	YA
1	Concealed Overhead Stop	1-X36	630	RF
1	Door Closer	7500 DA G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88D		PE

Set: 11.0
Description: Comm/ Elec / Mech Rooms

1	Continuous Hinge	FM300 7'0 WHI Auto Door Btm Cut	630	MR
1	Mortise Lock (storeroom)	AUR 8805FL GMK CMK 2815	630	YA
1	Door Closer	PR7500 G	689	NO
1	Wall Protector Stop	390-S	IVO	00
1	Gasketing	S88D		PE

Set: 12.0
Description: Clinical Sink

1	Continuous Hinge	FM300 7'0	630	MR
1	Mortise Lock	PBR 8808FL GMK CMK 2815	630	YA
1	Concealed Overhead Stop	2-X36	630	RF
1	Kickplate	K1050 10" 4BE CSK	US32D	RO

Set: 13.0
Description: Gown Waiting (MHO)

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Mortise Lock (passage)	AUR 8801FL 2815	630	YA
1	Surface Closer	J7540ST 7786JP 9610 JWG	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Electromagnetic Holder	997	689	RF
1	Gasketing	S88D		PE

Notes: Fire alarm relay and wiring to shunt power to Magnetic Holder by Fire Alarm Division

Set: 14.0
Description: Ante Room (CR MHO)

1	Continuous Hinge	FM300 7'0 MB WHI	630	MR
1	Electrified Mortise Lock	AUR 8891FL GMK REX CMK 2815	630	YA
1	Door Closer	PR7500 G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Electromagnetic Holder	997	689	RF
1	Gasketing	S88D		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
1	Position Switch	DPS-W-WH		SU
2	Hands-free Activation Switch	CM 325/41 WS		CA

Notes: Access Control Reader furnished by Security Integrator. Fire alarm relay and wiring to shunt power to Magnetic Holder by Fire Alarm Division. Hands-free activators to release magnetic door holder

Set: 15.0
Description: Computer Room

3	Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Electrified Mortise Lock	PBR 8891FL GMK REX CMK 2815	630	YA
1	Concealed Overhead Stop	2-X36	630	RF
1	Door Closer	7500 G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing	S88D		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
1	Position Switch	DPS-W-WH		SU

Notes: Access Control Reader furnished by Security Integrator

Set: 16.0
Description: Control / Bio Hazard Room

3	Hinge	TA2314 4-1/2" x 4-0"	US32D	MK
1	Electrified Mortise Lock	AUR 8891FL GMK REX CMK 2815	630	YA
1	Door Closer	PR7500 G	689	NO
1	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Wall Protector Stop	390-S	IVO	00
1	Gasketing	S88D		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
1	Position Switch	DPS-W-WH		SU

Notes: Access Control Reader furnished by Security Integrator

Set: 17.0
Description: Reception Waiting

6	Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1	Flush Bolt	2948	US26D	RO
1	Mortise Lock	PBR 8808FL GMK CMK 2815	630	YA
1	Coordinator	2672	US28	RO
2	Mounting Bracket	2601AB	US28	RO
2	Door Closer	PR7500 DA G	689	NO
2	Kickplate	K1050 10" 4BE CSK	US32D	RO
2	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE
1	Astragal	357SP		PE

Set: 18.0
Description: Charting (MHO)

2	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Flush Bolt	2948	US26D	RO
1	Mortise Lock (passage)	AUR 8801FL 7/8" LTC STK	630	YA
1	Coordinator	2672	US28	RO
2	Surface Closer	7540ST 7786JP	689	NO
2	Kickplate	K1050 10" 4BE CSK	US32D	RO
2	Electromagnetic Holder	997	689	RF
1	Gasketing	S88D		PE
1	Astragal	357SP		PE

Set: 19.0
Description: PACU(AUTO)

1~~2~~	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Continuous Hinge	FM300 7'0 WHI CTP	630	MR
1	Flush Bolt	2948	US26D	RO
1	Mortise Lock (classroom)	PBR 8808FL GMK CMK 2815	630	YA
1	ElectroLynx Adaptor	2004M		HS
1	Rectifier	2001M		HS
1	Electric Strike	1006-F-LBM	630	HS
1	Electric Strike Faceplate	KM	630	HS
1	Coordinator	2680	US28	RO
~~2~~	~~Door Closer~~	~~7500 DA G~~	~~689~~	~~NO~~
2	Armor Plate	K1050 F >34" UL 4BS CSK	US32D	RO
2	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE
1	Astragal	357SP		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
2	Position Switch	DPS-M-WH		SU

Notes: Uneven pair - 48" active leaf

Set: 20.0
Description: MRI (AUTO) RF Shielded

~~1~~	~~Continuous Hinge~~	~~FM300 7'0~~	~~630~~	~~MR~~
~~1~~	~~Storeroom Lock~~	~~PB 5405LN CMK GMK~~	~~626~~	~~YA~~
~~1~~	~~ElectroLynx Adaptor~~	~~2004M~~		~~HS~~
~~1~~	~~Face Plate~~	~~852M~~	~~630~~	~~HS~~
~~1~~	~~Rectifier~~	~~2001M~~		~~HS~~
~~1~~	~~Electric Strike~~	~~8300-LBM~~	~~630~~	~~HS~~
~~1~~	~~Door Stop~~	~~441H~~	~~US26D~~	~~RO~~
~~3~~	~~Silencer~~	~~608~~		~~RO~~
~~1~~	~~ElectroLynx Harness~~	~~QC-C1500P~~		~~MK~~

Notes: ~~Door and hardware provided by Division 13 Section 130950 Radio Frequency Shielding including door auto operator.~~ Door and hardware provided by Division 13 Section 130950 Radio Frequency Shielding, including door auto operator.

Set: 21.0
Description: Angio Room (AUTO)

1	Continuous Hinge	FM300 7'0 WHI	630	MR
1	Continuous Hinge	FM300 7'0 WHI CTP	630	MR
1	Flush Bolt Set	2842	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (storeroom)	PBR 8805FL GMK CMK 2815	630	YA
1	ElectroLynx Adaptor	2004M		HS
1	Rectifier	2001M		HS
1	Electric Strike	1006-F-LBM	630	HS
1	Electric Strike Faceplate	KM	630	HS
1	Coordinator	2680	US28	RO
2	Armor Plate	K1050 F >34" UL 4BE CSK	US32D	RO
2	Door Stop	406	US32D	RO
1	Gasketing	S88D		PE
1	Astragal	357SP		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
2	Position Switch	DPS-M-WH		SU

Notes: Power Operators, actuation switches and wiring connections by Division 087113 Access Control Reader furnished by Security Integrator

Set: 22.0
Description: Nuclear Med / CT Scan Room (AUTO)

1~~2~~	Continuous Hinge	FM300 7'0 WHI	630	MR
1~~2~~	Continuous Hinge	FM300 7'0 WHI CTP	630	MR
1	Flush Bolt Set	2842	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (storeroom)	PBR 8805FL GMK CMK LEAD LINED	630	YA
1	ElectroLynx Adaptor	2004M		HS
1	Rectifier	2001M		HS
1	Electric Strike	1006-F-LBM	630	HS
1	Electric Strike Faceplate	KM	630	HS
1	Coordinator	2680	US28	RO
2	Concealed Overhead Stop	1-X36	630	RF

2	Armor Plate	K1050 F >34" UL 4BE CSK	US32D	RO
1	Gasketing	S88D		PE
1	Astragal	357SP		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	Electric Power Transfer	EL-CEPT		SU
1	ElectroLynx Harness	QC-C300		MK
2	Position Switch	DPS-M-WH		SU

Notes: Power Operators, actuation switches and wiring connections by Division 087113
Access Control Reader furnished by Security Integrator

Set: 23.0
Description: Clean Hold

2	Continuous Hinge	FM300 7'0	630	MR
1	Flush Bolt	2948	US26D	RO
1	Mortise Lock (classroom)	PBR 8808FL GMK CMK 2815	630	YA
1	Coordinator	2660	US28	RO
1	Mounting Bracket	2601AB	US28	RO
1	Door Closer	PR7500 DA G	689	NO
1	Door Closer Plus	CPS7500 DA G SN-134	689	NO
2	Kickplate	K1050 10" 4BE CSK	US32D	RO
1	Door Stop	406	US32D	RO
1	Astragal	357SP		PE
2	Silencer	608		RO

Set: 24.0
Description: Sliding Glass Doors

1	Cylinder	2153 GMK CMK	626	YA

Notes: Balance of hardware complete by Sliding Glass Door Division

END OF SECTION 087100

SECTION 087113 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Power door operators for swinging doors.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Double-Swing (Doors): A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.

D. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

E. For automatic door terminology, see BHMA A156.10 and BHMA A1546.19 for definitions of terms.

1.4 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control automatic door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

E. Pneumatic System Roughing-in: Coordinate layout and installation of automatic door operators and power units with compressed-air piping.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard size.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of automatic door operator.For each operator for fire-rated door assemblies, certify that operator is listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

C. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Certified Inspector Qualifications: Certified by AAADM.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of automatic door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
2. LCN Closers; an Ingersoll-Rand company.
3. Stanley Access Technologies, LLC; Div. of Stanley Security Solutions.

B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Electrohydraulic Operating System: Self-contained, low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.

C. Hinges: See Section 087100 "Door Hardware" for hinge type for each door that door operator shall accommodate.

D. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch-thick, extruded or formed aluminum and extending full width of door opening including door jambs to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

F. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER DOOR OPERATORS

A. Standard: BHMA A156.1~~0~~9.

B. Performance Requirements:

1. Opening Force:

a. Power-Operated Swinging Doors: Not more than 30 lbf required to manually open door if power fails.

2. Entrapment-Prevention Force: Not more than 40 lbf required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf required to prevent stopped door from moving in direction of closing.

C. Configuration: Operator to control single swinging door pair of swinging doors.

1. Traffic Pattern: ~~One~~Two way.
2. Operator Mounting: Overhead concealed.

D. Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.1~~0~~9.

E. Operating System: Electrohydraulic.

F. Microprocessor Control Unit: Solid-state controller.

G. Features:

1. Adjustable and closing speed.
2. Adjustable hold-open time from zero to 30 seconds.
3. Adjustable limit switch.
4. Obstruction recycle.
5. Automatic door re-open if stopped while closing.
6. .

H. Controls: Activation and safety devices as indicated on Drawings and according to BHMA standards.

1. Activation Device: ~~Push-plate switchto activate door operator~~Handsfree hospital grad activation or security card reader as shown on plans.
2. Safety Device: ~~One photoelectric beam mounted in guide rails to detect pedestrians in presence zone and to prevent door from closing~~Provide presence sensors mounted overhead and on door leaves compliant with BHMA A156.10 standards on BHMA A156.19 doors in patient areas.

I. Exposed Finish: Finish matching door hardware.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B 221.
2. Sheet: ASTM B 209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

A. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

C. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message. Provide where shown on drawings.

1. Configuration: Square push plate with 4-by-4-inch junction box.

a. Mounting: As indicated on Drawings.

2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
3. Message: International symbol of accessibility and "Push to Open."

D. Handsfree Door Activator: Provide handsfree door activator with short range infra-red sensor. The switches shall be jamb/narrow, single gang or double gang, with stainless steel or polycarbonate faceplate, as required. They shall have an on-board LED for ease of setup, fail-safe or non-fail-safe selectable, have an adjustable minimum operating range of 2" and a maximum operating range of not more than 18", regardless of the reflective material placed within the sensor field. The switch shall have a relay contact rating of 5 amps @ 30 VDC and shall also be ROHS compliant. Switches mounted outdoors, or exposed to interior water/humidity shall be mounted with weather resistant integral rubber gasket and back box, supplied by the same manufacturer.

1. Acceptable Manufacturers:

a. Camden Door Controls (CA) - CM-325 Series
b. "Wave to Open" with hand
c. Stainless Steel faceplate

2. Provide where shown on plans.

E. Proximity Card/FOB reader: Provide security proximity card/fob reader to match facility standard. Provide where shown on plans.

F. At fire rated doors provide connection to Fire Alarm system relay to cut power to doors.

2.6 FABRICATION

A. Factory fabricate automatic door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.7 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Operator manufacturer's standard process.

2. Provide sign materials with instructions for field application when operators are installed.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before automatic door operator installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Access-Control System: Connect operators to access-control system as specified in Section 281300 "Access Control."

D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

E. Guide Rails: Unless shown on plans, install only on BHMA A156.10 doors according to BHMA A156.10, including Appendix A and manufacturer's written instructions unless otherwise indicated.

F. Fire Rated Doors: Install as required to provide fire rating as scheduled. Coordinate auto door system and door latching system so that door will close and latch as required by fire listing on loss of power. System shall be configured so that only one fire alarm relay is required. If additional fire alarm relays are required for proper function they shall be included as necessary.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Owner will engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic door operators will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for weathertight closure.

B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for interior windows, doors, interior borrowed lites, and glazed curtain walls.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 088113 "Decorative Glass Glazing."
2. Section 088300 "Mirrors."
3. Section 088813 "Fire-Resistant Glazing."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Regulatory Requirements: Comply with Chapter 24 of the 2013 California Building Code (CBC), including additional requirements for OSHPD 1.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:

1. AGC Glass Company North America, Inc.
2. Berkowitz, JE, LP.
3. Cardinal Glass Industries.
4. Cristacurva Glass.
5. Dlubak Corporation.
6. Gardner Glass Products, Inc.
7. General Glass International.
8. Glasswerks LA, Inc.
9. Glaz-Tech Industries.
10. Guardian Industries Corp.
11. Hartung Glass Industries.
12. Northwestern Industries, Inc.
13. Oldcastle BuildingEnvelope.
14. Pilkington North America Inc.
15. PPG Industries, Inc.
16. Saint-Gobain Corporation.
17. Schott North America, Inc.
18. Tecnoglass S. A.
19. Trulite Glass & Aluminum Solutions.
20. Viracon, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer registered in California, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Comply with labeling requirements of Section 2406.3 of the 2013 California Building Code (CBC).

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

1. For human impact loads, comply with Section 2406.1 of the 2013 California Building Code (CBC).

2.4 GLASS PRODUCTS

A. Refer to glazing indicated on Drawings for glass types, manufacturers, products, material characteristics, and colors.

B. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.

2.5 LAMINATED GLASS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by Viracon, Inc.

B. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

C. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by Viracon, Inc.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Construction Sealants; Momentive Performance Materials Inc; SilPruf LM SCS2700.
c. May National Associates, Inc.; Bondaflex Sil 290.
d. Pecora Corporation; 890NST.
e. Sika Corporation; Sikasil WS-290.
f. Tremco Incorporated; Spectrem 1.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

    a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 GLASS SCHEDULE

A.

B. Glass Type GL-1: Clear annealed float glass.

1. Minimum Thickness: 6 mm.

C. Glass Type GL-2: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

D. Glass Type GL-3: Clear annealed float glass.

1. Minimum Thickness: 12 mm.

E. Glass Type GL-4: Clear fully tempered float glass.

1. Minimum Thickness: 12 mm.
2. Safety glazing required.

3.9 LAMINATED GLASS SCHEDULE

A. Glass Type GL-9: One way; tinted laminated glass with two plies of annealed float glass with outer ply tinted and inner ply clear.

1. Basis-of-Design Product: Pilkington North America, Inc.; Mirropane.
2. Tint Color: Gray.
3. Minimum Thickness of Each Glass Ply: 3 mm.
4. Interlayer Thickness: 0.030 inch (0.76 mm) (1.52 mm) (2.29 mm).

3.10 INSULATING GLASS SCHEDULE

A. Glass Type OF-1: Existing vision panels, with film applied.

1. Basis-of-Design Product: 3M; Privacy Series Window FIlm.

a. Color: To match existing adjacent panels.

B. Glass Type VG-1: Clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm) (16 mm).
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Annealed float glass.
4. Interspace Content: Air.
5. Indoor Lite: Annealed or fully tempered, as indicated; float glass.

C. Glass Type SG-1: Ceramic-coated, tinted, insulating spandrel glass.

1. Coating Color: Match existing adjacent panels.
2. Overall Unit Thickness: 1 inch (25 mm)>.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted annealed float glass.
5. Interspace Content: Air.
6. Indoor Lite: Clear annealed or fully tempered, as indicated; float glass.
7. Coating Location: Fourth surface.

END OF SECTION 088000

SECTION 088113 - DECORATIVE GLASS GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Patterned glass.
2. Glass with finished edges.

1.3 DEFINITION

A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:

1. Size and location of penetrations.
2. Glazing method.
3. Mounting method.
4. Attachments to other work.
5. Full-size details of edge-finished profiles.

C. Glass Samples: For the following products, 12 inches square:

1. Each type of decorative glass.
2. Each edge treatment on type of decorative glass.
3. Each decorative film overlay on type of decorative glass.
4. Each applied coating on type of decorative glass.

D. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative of the glazed system.

E. Decorative Glazing Schedule: List decorative glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

F. Delegated-Design Submittal: For decorative glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of decorative glass.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative glass to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under NGA's Certified Glass Installer Program.

B. Regulatory Requirements: Comply with Chapter 24 of the 2013 California Building Code (CBC), including additional requirements for OSHPD 1.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect decorative glass and glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Retain packaging and sequencing numbers for decorative-glass units.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer registered in California, as defined in Section 014000 "Quality Requirements," to design decorative glass.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and "GANA's "Glazing Manual" unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Comply with labeling requirements of Section 2406.3 of the 2013 California Building Code (CBC).

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with requirements indicated. Where heat-strengthened glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with requirements indicated. Where fully tempered glass is indicated, provide fully tempered float glass.

1. For human impact loads, comply with Section 2406.1 of the 2013 California Building Code (CBC).

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Patterned Glass: ASTM C 1036, Type II, Class 1 (clear) or Class 2 (tinted) as indicated, Form 3; finish, pattern, and quality as indicated.

D. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear) or Class 2 (tinted) as indicated, Form 3; finish, pattern, and quality as indicated.

2.5 GLAZING MATERIALS

A. Glazing Sealants, Tapes, and Miscellaneous Glazing Materials: As specified in Section 088000 "Glazing."

1. Colors: As selected by Architect from manufacturer's full range.

2.6 HARDWARE FOR GLASS INSTALLATION

A. Hardware: Continuous top and bottom glazing channel.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. EPCO, Engineered Products Co.
b. Gyford Productions, LLC.
c. KL megla America, LLC.
d. Laurence, C. R. Co., Inc.
e. Sugatsune America, Inc.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Gaskets: Manufacturer's standard, compatible with decorative glass type indicated.

D. Anchors and Inserts: Provide devices as required for hardware installation. Provide metal expansion-bolt devices for drilled-in-place anchors. Provide stainless-steel anchors and inserts for applications on inside face of exterior walls and where indicated.

2.7 DECORATIVE-GLASS FABRICATION

A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.

1. Edge-Finished Glass Adhesive: Clear, nonyellowing, as recommended by manufacturer.

C. Lite Treatment: as indicated on Drawings with smooth, uniform edge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine decorative-glass framing members, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.
3. Effective sealing between joints of decorative-glass framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate orientation of outer surfaces as indicated on Drawings. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 INSTALLATION

A. Set decorative-glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

B. Set glass lites with proper orientation so that each outer surface faces the direction indicated on Drawings.

C. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces and building structure.

D. Set decorative glass in locations indicated on Drawings..

3.4 GLAZING, GENERAL

A. Decorative Glass: Install glazing as specified in Section 088000 "Glazing."

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088113

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Tempered glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Trim: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror and mirror mastic.

C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Avalon Glass and Mirror Company.
2. Binswanger Glass.
3. Donisi Mirror Company.
4. D & W Incorporated.
5. Gardner Glass Products, Inc.
6. Glasswerks LA, Inc.
7. Guardian Industries Corp.
8. Independent Mirror Industries, Inc.
9. Lenoir Mirror Company.
10. National Glass Industries.
11. Trulite Glass & Aluminum Solutions.
12. Virginia Mirror Company, Inc.
13. Walker Glass Co., Ltd.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

1. Nominal Thickness: As indicated.

C. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Franklin International.

b. Laurence, C. R. Co., Inc.
c. Liquid Nails Adhesive.
d. Palmer Products Corporation.
e. Royal Adhesives & Sealants, LLC.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Andscot Company, Inc.
2) Laurence, C. R. Co., Inc.
3) Stylmark, Inc.

2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Andscot Company, Inc.
2) Laurence, C. R. Co., Inc.
3) Stylmark, Inc.

3. Finish: Clear bright anodized.

2.5 FABRICATION

A. Fabricate mirrors in the shop to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 088813 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection-rated glazing.

B. Related Requirements:

1. Section 081113 "Hollow Metal Frames and Doors."
2. Section 088000 "Glazing."
3. Section 088113 "Decorative Glass Glazing."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Regulatory Requirements: Comply with Chapter 24 of the 2013 California Building Code (CBC), including additional requirements for OSHPD 1.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."

B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

1. Comply with labeling requirements of Section 2406.3 of the 2013 California Building Code (CBC).

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.
2. Comply with Section 716.6 of the 2013 California Building Code (CBC).

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

1. Comply with labeling requirements of Section 716.6.8 of the 2013 California Building Code (CBC).

C. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 5-mm thickness; faced on one surface with a clear glazing film; and complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Technical Glass Products; FireLite NT.

2.6 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 795.
    b. GE Construction Sealants; Momentive Performance Materials Inc; SilGlaze II SCS2800.
    c. Tremco Incorporated; Spectrem 2.

2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088813

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly. Include manufacturer's printed installation instructions and certification that product meets specification requirements.

B. Shop Drawings: Submit elevation drawings of visible wall areas with door frames at less than ceiling height, and at exposed soffits where full height studs with slip joints meet the soffit framing. Indicate control joint locations from top of door frames to ceiling at corners of frames, and at intersections of stud slip joints and soffit framing.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies firestop tracks, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier. Deliver fire-rated materials bearing testing agency label and required fire classification.

B. Handle materials with care to prevent damage.

C. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Protect adjacent surfaces against damage and stains.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: As indicated.

C. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: As indicated.

D. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

E. Room-Side Finish: Gypsum board.

F. Shaft-Side Finish: As indicated.

G. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corporation.; ProRoc Moisture and Mold Resistant Shaftliner.
   b. Georgia-Pacific Building Products, Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
   c. Lafarge North America, Inc.; Firecheck Moldcheck Type X Shaftliner.
   d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
   e. PABCO Gypsum; Pabcore Mold Curb Shaftliner Type X.
   f. Temple-Inland Building Product by Georgia-Pacific.; Fire-Rated SilentGuard TS Mold-Resistant Gypsum Shaftliner System.
   g. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

C. Gypsum Board: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ClarkDietrich, Blazeframe Firestop Deflection Track with integral intumescent tape.
   b. ClarkDietrich, Blazeframe 2 Firestop Deflection Tracks with integral intumescent tape.
   c. MarinoWare; Fas Track 1000 with integral intumescent tape.
   ~~?. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.~~

?. Grace Construction Products; W.R. Grace & Co; FlameSafe FlowTrak System.
?. Metal-Lite; The System.
?. Steel Network Inc. (The); VertiTrack VTD Series.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

F. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, authorities having jurisdiction and the governing building codes, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies, and as follows:

1. Uninterrupted Wall lengths: From floor to ceiling at maximum spacing of 30 feet.
2. Door frames: At door frames less than ceiling height, install control joints from top of frame to the ceiling at both corners.
3. At Soffits: Where full height studs with slip joints meet rigidly hung soffit framing, install control joints at visible locations.

H. Comply with ASTM E119 for required fire-resistance-rating for control joints in fire-resistance-rated assemblies.

I. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install 2 continuous beads of acoustical sealant, one on each side of shaft wall assembly, to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

1. Coat backs of boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items with sealant and seal perimeters.

J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for insulation installed with Z-shaped furring members.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's printed installation instructions and certification that product meets specification requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track
2) MBA Building Supplies; FlatSteel Deflection Track.
3) Steel Network Inc. (The); VertiTrack VTD Series.
4) Superior Metal Trim; Superior Flex Track System (SFT).
5) Telling Industries; Vertical Slip Track II.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ClarkDietrich, Blazeframe Firestop Deflection Track with integral intumescent tape.
b. ClarkDietrich, Blazeframe 2 Firestop Deflection Tracks with integral intumescent tape.
c. MarinoWare; Fas Track 1000 with integral intumescent tape.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Flat Hangers: Steel sheet, in size indicated on Drawings.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

2. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

1. Backer Plates: Install runner channels horizontally, notched over and attached to wall studs to provide surface area requirements for attachment of casework, equipment, and accessories. Install backer plates in accordance with OSHPD requirements and OSHPD-approved details.

a. Attach backer plates to a minimum of three framing studs.
b. Weld backer plates thicker than 0.039 inches (0.91 mm) to framing studs; bolt backer plates less than 0.039 inches (0.91 mm) thick to framing studs or screw-attach with self-drilling screws.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
2. Section 078413 "Penetration Firestopping" for firestop sealant installed in assemblies that incorporate gypsum board.
3. Section 078443 "Joint FIrestopping" for head-of-wall assemblies that incorporate gypsum board.
4. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
5. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
6. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.
7. Section 099123 œInterior Painting for primers applied to gypsum board surfaces.
8. Section 134900 "Radiation Protection" for lead-lined gypsum board for x-ray protection.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's printed installation instructions and certification that product meets specification requirements.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. Shop Drawings: Submit elevation drawings of visible wall areas with door and window frames at less than ceiling height, and at exposed soffits where full height studs with slip joints meet the soffit framing. Indicate control joint locations from top of door and window frames to ceiling at corners of frames, and at intersections of stud slip joints and soffit framing.

1.4 QUALITY ASSURANCE

A. Reference Standards and Specifications:

1. Comply with reference standards specified in this Section.
2. In cases of conflict between requirements specified in this Section, applicable legal requirements, and the reference standards and specifications, comply with the more restrictive requirements.

B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site with manufacturer's labels intact and legible. Deliver fire-resistance-rated materials bearing testing agency label and required fire classification.

B. Handle materials with care to prevent damage.

C. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1. Submit written evidence of acceptance by authorities having jurisdiction of the assemblies proposed to be used prior to starting work.
2. Materials used in fire-resistance-rated construction shall be by the same manufacturer as those used in the tested, approved assembly.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company, FireShield Type XP or other comparable product which allows the wall assembly to meet the STC rating indicated on the Drawings.
~~1.~~2. Thickness: 5/8 inch.
~~2.~~3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company, Gold Bond High Impact XP or other comparable product which allows the wall assembly to meet the STC rating indicated on the Drawings.
2. Core: 5/8 inch, Type X unless otherwise indicated on Drawings.
3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
6. Hard Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629.
7. Long Edges: Tapered.
~~3.~~8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

~~D.~~E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

A. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.

1. Basis-of-Design Product: Subject to compliance with requirements, provide National Gypsum Company, Gold Bond SoundBreak XP or other comparable product which allows the wall assembly to meet the STC rating indicated on the Drawings.
2. Core: 5/8 inch, Type X.
3. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629.

4. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
5. Soft Body Impact Resistance: Classification Level 2 in accordance with ASTM C 1629.
6. Hard Body Impact Resistance: Level 1 in accordance with ASTM C 1629.
7. Mold Resistance:

   a. 10 when tested in accordance with ASTM D 3273.
   b. 0 when tested in accordance with ASTM G 21.

~~2.4~~2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corp.; GlasRoc Tile Backer.
   b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

2. Core: As indicated on Drawings.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

~~2.5~~2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Fry Reglet Corp.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

~~2.6~~2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M. Provide gypsum board manufacturer's standard products.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Spot Grouting: Formulation that is compatible with other compounds applied to panels.

D. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

~~2.7~~2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Self-drilling, self-tapping, countersunk bugle head drywall screws, for use with power driven tool.

    a. Type S for gypsum board to metal application.
    b. Type G for gypsum board to gypsum board application.

2. Fire-resistant-rated construction: Use type and length of screws to comply with fire-resistance-rating.
3. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
4. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

~~?. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.~~

~~?. Products: Subject to compliance with requirements, provide one of the following:~~

~~?. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.~~

~~?. Grabber Construction Products; Acoustical Sealant GSC.~~
~~?. Pecora Corporation; AC-20 FTR.~~
~~?. Specified Technologies, Inc.; Smoke-N-Sound Acoustical Sealant.~~
~~?. USG Corporation; SHEETROCK Acoustical Sealant.~~
~~?. .~~

D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

E. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

F. Firestop Sealant: As specified in Section 078413 "Penetration Firestopping."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that framing is plumb and true, with maximum variation of 1/8 inch of the fastening surface of any framing or furring member from the plane of the faces of adjacent framing or furring members.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with Gypsum Association GA-216: Application and Finishing of Gypsum Panel Products and ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Where called for at door frame anchors, provide spot grouting to stabilize the door frame. Apply grout just before inserting the panel into the frame.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Apply acoustical sealant with power gun in joints. Apply continuous layer of sealant to backs of electrical boxes and similar items penetrating gypsum panels, and seal perimeter of the openings. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings Where required for fire-resistance-rated assembly.
2. Ceiling Type: Ceiling surfaces.
3. Abuse-Resistant Type: As indicated on Drawings.
~~3.~~4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
5. Acoustically Enhanced Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
    c. Where panels abut tile backing panels, shim panels to produce a uniform plane across panel surfaces.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws. Space screws at maximum 8 inches on center around the perimeter, at 12 inches on center on the intermediate studs, and as required to meet fire-resistance-rating requirements.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws. Space screws as required to meet fire-resistance-rating requirements.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect, and as follows:

   a. Uninterrupted wall lengths: From floor to ceiling at maximum spacing of 30 feet.
   b. Door and window frames: At door and window frames less than ceiling height, install control joints from top of frame to the ceiling at both corners
   c. At soffits: Where full height studs with slip joints meet rigidly hung soffit framing, install control joints at visible locations.

   2. Comply with ASTM E119 for required fire-resistance-rating for control joints in fire-resistance-rated assemblies.

C. Interior Trim: Install in the following locations:

   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use at outside corners.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to Gypsum Association GA-214: Recommended Levels of Gypsum Board Finish and ASTM C 840:

1. Level 4 or better finish is required for visible surfaces to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes. Architect will determine acceptance of gypsum board finish. Provide additional coats if required, at no additional cost to the Owner until surface is acceptable.
2. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

    a. Set tape for joints and interior angles in joint compound. Remove excess joint compound from surface. Tool marks and ridges are acceptable.

3. Level 2: Panels that are substrate for tile Where indicated on Drawings.

    a. Embed tape in joint compound at joints and interior angles; wipe with a joint knife leaving a thin coating of joint compound over joints and interior angles. Cover fastener heads and accessories with a coat of joint compound. Remove excess joint compound from surface. Tool marks and ridges are acceptable.

4. Level 3: Where indicated on Drawings.

    a. Embed tape in joint compound at joints and interior angles, and apply one additional coat of joint compound over joints and interior angles. Cover fastener heads and accessories with two separate coats of joint compound. Leave joint compound surface smooth and free of tool marks and ridges.

5. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Embed tape in joint compound at joints and interior angles, and apply two separate coats of joint compound over flat joints and one separate coat of joint compound over interior angles. Cover fastener heads and accessories with three separate coats of joint compound. Leave joint compound surface smooth and free of tool marks and ridges.
    b. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

6. Level 5: Areas where gloss, semigloss, enamel, or non-textured flat paints will be applied, or where severe lighting conditions occur.

a. Embed tape in joint compound at joints and interior angles, and apply two separate coats of joint compound over flat joints and one separate coat of joint compound over interior angles. Cover fastener heads and accessories with three separate coats of joint compound. Apply a thin skim coat of joint compound to the entire surface. Leave surface smooth and free of tool marks and ridges.
b. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

7. Joints and fasteners shall not be discernable on finished surfaces after painting.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Waterproof membrane for thinset applications.
5. Metal edge strips.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including installation instructions and certification that product meets specification requirements.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association ora Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers orinstallers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of wall tile installation.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels identifying brand name and contents intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store panel materials inside under cover, in a dry location protected from weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

D. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

E. Store liquid materials in unopened containers and protected from freezing.

F. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Protect adjacent work and work of other trades during installation of backing panels and tile.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Waterproof membrane.
2. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

A. Ceramic Tile Type: Factory-mounted glazed ceramic mosaic tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.
2. Tile Color, Finish and Pattern: As specified in Interior Design Drawings.
3. Grout Color: As specified in Interior Design Drawings.
4. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as specified in Interior Design Drawings.

B. Ceramic Tile Type: Unglazed porcelain tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.
2. Tile Color, Finish and Pattern: As specified in Interior Design Drawings.
3. Grout Color: As specified in Interior Design Drawings.
4. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as specified in Interior Design Drawings.

C. Ceramic Tile Type: Glazed wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.
2. Tile Color, Finish and Pattern: As specified in Interior Design Drawings.
3. Grout Color: As specified in Interior Design Drawings.
4. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as specified in Interior Design Drawings.

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Noble Company (The); Nobleseal TS.

2. Nominal Thickness: 0.030 inch.

C. Waterproofing and Tile-Setting Adhesive: One-part, fluid-applied product, that complies with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," intended for use as both waterproofing and tile-setting adhesive in a two-step process.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Hydroment Ultra-Set Advanced.

2.5 SETTING MATERIALS

A. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Interior Design Drawings.

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Interior Design Drawings.

2.7 MISCELLANEOUS MATERIALS

A. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Section 090000 "Finish Material and Color Legend."

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products or comparable product by one of the following:

a. Bonsal American, an Oldcastle company; Grout Sealer.
b. Jamo Inc.; Surfaceguard Sealer.
c. Southern Grouts & Mortars, Inc.; Grout Sealer.
d. Summitville Tiles, Inc.; SL-15, Invisible Seal.
e. TEC, H. B. Fuller Construction Products Inc.; Grout Guard Plus Penetrating Grout Sealer.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Examine adjoining areas of work and verify that they are satisfactorily protected.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the joint widths as recommended by manufacturer and as indicated on Interior Design Drawings.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install at locations indicated.

K. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

SECTION 095000 - WOOD PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes wood panels and suspension systems for ceilings.

B. Related Requirements:

1. Section 233713 "Diffusers, Registers, And Grilles• for air grilles and diffusers.
2. Section 265100 "Interior Lighting" for lighting fixtures.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's recommendations for installation of suspension system.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

c. Speakers.
d. Sprinklers.
e. Access panels.
f. Smoke Detectors.

5. Perimeter moldings.
6. Locate ceiling mounted items in center of ceiling panels measured in both directions unless indicated otherwise.
7. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Regulatory Requirements:

1. Comply with Sections 808.1, 808.1.1, and 2506.2.1 of the 2013 California Building Code (CBC).
2. Metal Suspension Systems: Conform with ASTM C 635 listed in Chapter 35 of the 2013 California Building Code (CBC) and Section 13.5.6 of ASCE/SEI 7 as modified in Section 1616A.1.20 of the 2013 California Building Code (CBC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood panels, suspension-system components, and accessories to Project site in original, unopened packages with labels indicating brand name, pattern, size, and thickness legible and intact and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing wood panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle wood panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install wood panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning wood panel ceiling installation.

1.10 COORDINATION

A. Coordinate layout and installation of wood panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Wood ceiling shall withstand the effects of earthquake motions determined according to:

1. ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Wood Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of wood ceiling panel and supporting suspension system from single source from single manufacturer.

C. Wood Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 WOOD PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.

b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure wood panels in place.

2.5 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong, Inc.; Prelude XL 15/16 inch exposed tee system.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Armstrong, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit wood panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which wood panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of wood panel ceilings.

B. Examine wood panels before installation. Reject wood panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Proceed with installation only after materials sufficient to complete a room have been delivered to Project site.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of wood panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install wood panel ceilings to comply with ASTM C 635/C 635M and ASTM C 636/C 636M, Section 808.1 of the 2013 California Building Code (CBC), and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook," and as indicated on Drawings.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of wood ceiling area and where necessary to conceal edges of wood panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install wood panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned wood panels as follows:

a. As indicated on reflected ceiling plans.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of wood panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of wood panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Wood panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of wood panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:

1. Section 233713 "Diffusers, Registers, And Grilles• for air grilles and diffusers.
2. Section 265100 "Interior Lighting" for lighting fixtures.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's recommendations for installation of suspension system..

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

c. Speakers.
d. Sprinklers.
e. Access panels.
f. Smoke Detectors.

5. Perimeter moldings.
6. Locate ceiling mounted items in center of ceiling panels measured in both directions unless indicated otherwise.
7. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Regulatory Requirements:

1. Comply with Sections 808.1, 808.1.1, and 2506.2.1 of the 2013 California Building Code (CBC).
2. Metal Suspension Systems: Conform with ASTM C 635 listed in Chapter 35 of the 2013 California Building Code (CBC) and Section 13.5.6 of ASCE/SEI 7 as modified in Section 1616A.1.20 of the 2013 California Building Code (CBC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages with labels indicating brand name, pattern, size, and thickness legible and intact and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.10 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to:

1. ASCE/SEI 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
3. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
4. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

5. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion nchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

2.5 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong, Inc.; Prelude XL 15/16 inch exposed tee system.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Armstrong, Inc..

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Proceed with installation only after materials sufficient to complete a room have been delivered to Project site.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 635/C 635M and ASTM C 636/C 636M, Section 808.1 of the 2013 California Building Code (CBC), and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook," and as indicated on Drawings.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.

11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

B. Related Requirements:

1. Section 096543 "Linoleum Flooring" for linoleum floor coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

C. Lengths: ~~Cut lengths 48 inches (1219 mm) long or c~~Coils in manufacturer's standard length.

D. Outside Corners: Job formed.

E. Inside Corners: Job formed.

F. Colors: As specified on Interior Design Drawings.

2.2 RUBBER MOLDING ACCESSORY

A. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.

B. Description: Rubber cap for cove carpet nosing for resilient flooring reducer strip for resilient flooring joiner for tile and carpet transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As specified in Interior Design Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Primer: Non-staining type recommended by resilient product manufacturer.

C. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned. Double cut adjoining lengths, and install with tight butt joints no greater than 1/64 inch wide.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates. Press down so bottom cove edge of coved base follows floor profile.

E. Do not stretch resilient base during installation. Scribe base accurately to abutting materials.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes vinyl sheet flooring.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
2. Section 096543 "Linoleum Flooring" for linoleum floor coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch sections.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for resilient sheet flooring including resilient base and accessories.

a. Size: Minimum 100 sq. ft. for each type, color and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

A. Do not install sheet flooring until building climate control system has been operational and utilized for a period of no less than 30 days prior to flooring installation.

B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

D. Close spaces to traffic during resilient sheet flooring installation.

E. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

F. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL SHEET FLOORING WITH BACKING

A. Basis-of-Design Product: Subject to compliance with requirements, provide product listed in Interior Design Drawings.

B. Product Standard: ASTM F 1303.

1. Wear-Layer Thickness: Grade 1.
2. Overall Thickness: As standard with manufacturer.

C. Seamless-Installation Method: Heat welded.

D. Colors and Patterns: As specified in Interior Design Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: As specified in Interior Design Drawings.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

1. Mix and apply adhesives according to manufacturer's instructions. Provide safety precautions during mixing and application as recommended by adhesive manufacturer.
2. Cover only the amount of area that can be covered by flooring material within the recommended working time of the adhesive.
3. Work out wrinkles and air pockets. Roll floor covering in two directions starting at center of sheet.
4. Apply heavy coat of adhesive to vertical wall surface to receive integral-flash-cove base. Mask upper wall surface to avoid excess adhesive above contact line.
5. Do not soil adjacent walls, bases, or other surfaces with adhesives. Promptly remove spillage.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

J. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip installed level and securely fastened in place. Provide continuous sealant behind.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes linoleum sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified in manufacturer's standard size, but not less than 6-by-9-inch sections.

1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

C. Heat-Welded Seam Samples: For each linoleum flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to rigid backing and prepared by Installer for this Project.

D. Product Schedule: For linoleum flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of sheet flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for flooring including integral-flash-cove-base and accessories.

a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.

1. Sheet Flooring: Store rolls upright.

1.9 FIELD CONDITIONS

A. Do not install sheet flooring until building climate control system has been operational and utilized for a period of no less than 30 days prior to flooring installation.

B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

D. Close spaces to traffic during flooring installation.

E. Close spaces to traffic for 48 hours after flooring installation.

F. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LINOLEUM SHEET FLOORING

A. Basis-of-Design Product: Refer to Interior Design Drawings for Basis-of-Design vinyl sheet floor covering manufacturer and product information. Provide floor covering products listed there.

B. Linoleum Sheet Flooring: ASTM F 2034.

1. Roll Size: In manufacturer's standard length but not less than 78 inches wide.

C. Thickness: As indicated in Interior Design Drawings

D. Heat-Welding Bead: For seamless installation, solid-strand product of linoleum flooring manufacturer.

1. Color: As indicated in Section 090000 "Finish Material and Color Legend."

E. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by manufacturer.
2. Cove-Base Cap Strip: Square metal as indicated in Interior Design Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests recommended by linoleum flooring manufacturer, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until it is the same temperature as space where it is to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

1. Mix and apply adhesives according to manufacturer's instructions. Provide safety precautions during mixing and application as recommended by adhesive manufacturer.
2. Cover only the amount of area that can be covered by flooring material within the recommended working time of the adhesive.
3. Work out wrinkles and air pockets. Roll floor covering in two directions starting at center of sheet.
4. Apply heavy coat of adhesive to vertical wall surface to receive integral-flash-cove base. Mask upper wall surface to avoid excess adhesive above contact line.
5. Do not soil adjacent walls, bases, or other surfaces with adhesives. Promptly remove spillage.

G. Heat-Welded Seams: For seamless installation, comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll linoleum sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out linoleum sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

C. Integral-Flash-Cove Base: Cove flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from linoleum flooring before applying liquid floor polish.

1. Apply two coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Section 096816 "Sheet Carpeting."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet tile type, color, and dye lot.
5. Type of subfloor.

6. Type of installation.
7. Pattern of installation.
8. Pattern type, location, and direction.
9. Pile direction.
10. Type, color, and location of insets and borders.
11. Type, color, and location of edge, transition, and other accessory strips.
12. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Section 900000 "Finish Material and Color Legend."

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Certification or evidence of compliance with certification program under Quality Assurance below, and experience record showing training and experience in similar work.
2. List of facilities and equipment available to do the Work.

B. Brief description of similar work satisfactorily completed with locations, dates of contracts, and names and addresses of Owners.

C. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer with minimum 5 years experience who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide provide product specified in Interior Design Drawings.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Basis-of-Design Products: Subject to compliance with requirements, products of Roberts Consolidated Industries or W.F. Taylor Company, or as provided or recommended by carpet tile manufacturer.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, and verify dimensions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile installation and performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.
4. Remove waste and excess materials from project site.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Wood.
3. Gypsum board.
4. Mechanical and electrical items exposed to view in areas to be painted.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements, manufacturer's published technical data sheets, and application instructions.

1. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Apply mockups after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Comply with regulations of South Coast Air Quality Management District (SCAQMD) Rule 1113 - Architectural Coatings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in unopened containers bearing manufacturer's name and product description corresponding to designation on material list.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; where dust is being generated; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products specified in Interior Design Drawings for Basis-of-Design manufacturer, color and gloss level information.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction. Provide products that comply with the following limits for voc content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

C. Aromatic compounds: paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

~~C.~~ D. Colors: Refer to Interior Design Drawings.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.

2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Verify that removable plates, machined surfaces, finish hardware, and similar items already in place that are not to be painted have been removed before proceeding with surface preparation and painting.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

1. SSPC-SP 11.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

G. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

   a. Equipment, including panelboards and switch gear.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Tanks that do not have factory-applied final finishes.
   h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   i. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   j. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Coordinate with reinstallation of removed items under work of other Sections after painting operations are complete.

D. Remove surface-applied protection from items that were too large or heavy to be removed.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Subject to compliance with requirements, provide products listed in Interior Design Drawings.

END OF SECTION 099123

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Room-identification signs.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on the Drawings, or a comparable product as approved by Architect by one of the following:

1. Ace Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. Allen Industries Architectural Signage.

4. Allen Markings International.
5. APCO Graphics, Inc.
6. ASE, Inc.
7. ASI Sign Systems, Inc.
8. Best Sign Systems Inc.
9. Bunting Graphics, Inc.
10. Clarke Systems.
11. Diskey Architectural Signage Inc.
12. Fossil Industries, Inc.
13. InPro Corporation (IPC).
14. Mohawk Sign Systems.
15. Nelson-Harkins Industries.
16. Poblocki Sign Company, LLC.
17. Seton Identification Products.
18. Stamprite Supersine; a division of Stamp Rite Inc.
19. Vista System.
20. Vomar Products, Inc.

B. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Indicated on Drawings.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to phenolic backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
    b. Color(s): As selected by Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition: As indicated.
    b. Corner Condition in Elevation: As indicated.

4. Frame: Aluminum.

    a. Frame Depth: As indicated.
    b. Finish and Color: As selected by Architect from manufacturer's full range.

5. Mounting: Surface mounted to wall with concealed anchors.
6. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.2 PANEL-SIGN MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Steel Materials:

1. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 METALLIC-COATED STEEL FINISHES

A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.

B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using method specified above.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102123 - CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Curtain tracks and carriers.
2. Intravenous (IV) tracks, carriers, and bottle holders.
3. Cubicle dressing-area tub shower curtains.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for steel framing and supports for curtain tracks and IV tracks.
2. Section 092216 "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.
3. Section 095113 "Acoustical Panel Ceilings" for metal framing and furring for mounting items requiring anchorage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturers' literature for curtain and IV track and hardware, and durability, laundry temperature limits, fade resistance, applied curtain treatment, and fire-test-response characteristics for each type of curtain fabric indicated.
2. Include data for each type of track.

B. Shop Drawings:

1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details on blocking above ceiling and in walls.

C. Samples: For each exposed product and for each color and texture specified, 10 inches in size.

D. Curtain and Track Schedule: Use same designations indicated on Drawings.

E. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated, but no fewer than 10 units.
2. Curtains: Full-size units equal to 10 percent of amount installed for each size indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical cubicle, complete with track, curtain, and IV hanger, as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:

1. Launderable to a temperature of not less than 160 deg F.
2. Flame resistant and identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CURTAIN SUPPORT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide On The Right Track System.

B. Extruded-Aluminum Curtain Track: 1 1/2 inches (39 mm) high by 3/8 inch (10 mm) wide.

1. Curved Track: Factory-fabricated, 12-inch-radius bends.
2. Finish: Powder Coated White Finish.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. Suspended-Track Support: Not less than 5/8-inch-square tube.
2. End Stop: Removable with carrier hook.

D. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Hot-dip galvanized.

2.3 IV SUPPORT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ADC Hospital Equipment; Division of Automatic Devices Company; I.V. Support Systems or comparable product by one of the following:

1. Covoc Corporation.
2. C/S General Cubicle.
3. Diamond Drapery Co.
4. Imperial Fastener Company, Inc.
5. InPro Corporation.
6. A. R. Nelson Co.
7. Pryor Products.
8. Salsbury Industries.

B. IV Tracks: Extruded aluminum, not less than 1-1/4 inches wide or more than 1-1/2 inches wide by 3/4 inch high; with manufacturer's standard wall thickness.

1. Curved Track: Factory-fabricated, 12-inch-radius bends.
2. Finish: Clear anodized.

C. IV Carriers: Four nylon rollers and stainless-steel axles with ball bearings and with hanger loop fabricated from 1/4-inch-diameter stainless steel.

1. Basis-of-Design Product: ADC Hospital Equipment; Division of Automatic Devices Company; No. 1185 Carrier.

D. Telescoping IV Bottle Holders: 39-inch overall height with a 3/4-inch stainless-steel main shaft and a 3/8-inch stainless-steel inner shaft, minimum vertical adjustment of 16 inches; with four 1/4-inch stainless-steel arms with loops and a stainless-steel top loop to attach to carrier.

1. Basis-of-Design Product: ADC Hospital Equipment; Division of Automatic Devices Company; No. 1187 Adjustable Pendant.
2. Top Loop: Coated for nonconductivity.
3. Adjustment Control: Push button.

2.4 CURTAINS

A. Basis-of-Design Product: Subject to compliance with requirements, provide fabric listed in Interior Design Drawings.

B. Cubicle Curtain Fabric: Curtain manufacturer's standard, inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Products: Subject to compliance with requirements, provide fabric listed in Interior Design Drawings.

C. Curtain Loading Tool: Manufacturer’s standard loading tool, The Grabber.

2.5 CURTAIN FABRICATION

A. Fabricate curtains as follows:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor as follows:

a. Cubicle Curtains: 12 inches.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 20 feet in length, provide track fabricated from single, continuous length.

1. Curtain Track Mounting: As indicated on Drawings.
2. IV Track Mounting: Surface.

C. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

D. IV Bottle Holders: Unless otherwise indicated, install one IV hook on each IV track and hang one IV hanger.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Curtains: Hang curtains on each curtain track.

3.3 PROTECTION

A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

END OF SECTION 102123

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall guards.
2. Impact-resistant handrails.
3. Corner guards.
4. End-wall guards.
5. Abuse-resistant wall coverings.

B. Related Requirements:

1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.
2. Section 092900 "Gypsum Board."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Wall Guards: 12 inches long. Include examples of joinery, corners, end caps, and field splices.
2. Corner and End-Wall Guards: 12 inches long. Include example top caps.
3. Abuse-Resistant Wall Covering: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 96-inch- long units.
2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units.
3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.
b. Store wall-guard and handrail covers in a horizontal position.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 and Chapter 11B of the 2013 California Building Code (CBC).

2.3 WALL GUARDS

A. Crash Rail: Heavy-duty, PVC-free assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.
2. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; in dimensions and profiles indicated on Drawings.

a. Color and Texture: As specified in Interior Design Drawings.

3. Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
4. Bumper: Continuous, resilient bumper cushion(s).
5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
6. Accessories: Concealed splices and mounting hardware.

2.4 IMPACT-RESISTANT HANDRAILS

A. Structural Performance: Handrails, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform load of 50 lbf/ft. applied in any direction.
2. Concentrated load of 200 lbf applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

B. Combination Wood-Plastic Bumper Handrail: Manufacturer's standard, PVC-free assembly consisting of solid-wood handrail mounted above plastic bumper rail, both mounted on continuous retainer; with reveal between handrail and bumper serving as thumb recess on front side; with 1-1/2-inch- diameter gripping surface and finger recess on back side.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.
2. Accessories: Concealed splices, cushion(s), and mounting hardware.

2.5 CORNER GUARDS

A. Flush-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover that is flush with adjacent wall surface, installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.

a. Color and Texture: As specified in Interior Design Drawings.

3. Continuous Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Aluminum Cove Base: Nominal 4 inches high.

B. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.
2. Material: Stainless-steel sheet, Type 304.

2.6 END-WALL GUARDS

A. Flush-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer; including mounting hardware.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.
2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.

    a. Color and Texture: As specified in Interior Design Drawings.

3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Aluminum Cove Base: Nominal 6 inches high.

2.7 ABUSE-RESISTANT WALL COVERINGS

A. Laminated, Impact-Resistant Wall Panels: Rigid wall panels consisting of semirigid, plastic sheet wall covering material factory laminated to high-impact-resistant core, with moisture-resistant vapor barrier factory laminated to reverse side of panel for stability.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product specified in Interior Design Drawings.
2. Height: As indicated.
3. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
4. Color and Texture: As specified in Interior Design Drawings.
5. Mounting: Adhesive.

2.8 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Particleboard and Medium-Density Fiberboard: Manufacturer's standard

D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.9 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.10 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes washroom accessories.

B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.
2. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Regulatory Requirements:

1. Where accessories in bathing and toilet facilities are required to be accessible, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities", Sections 11B-603 and 11B-604 of the 2013 California Building Code (CBC), and ICC/ANSI A117.1.

C. Where grab bars, and tub and shower seats in bathing and toilet facilities are required to be accessible, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities", Sections 11B-604, 11B-607, 11B-608, 11B-609, and 11B-610 of the 2013 California Building Code (CBC), and ICC/ANSI A117.1.

2.2 WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products manufactured by Bobrick and as indicated on the Drawings. Subject to compliance with requirements, provide the named product or a comparable product as approved by Architect by one of the following:

1. GAMCO, A Division of Bobrick Washroom Accessories.
2. American Specialties, Inc. (ASI).
3. Bradley Corporation.
4. Columbia Accessories, A Division of PSiSC.

B. Accessories: As indicated on the Drawings, Sheet A710.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design Product: Subject to compliance with requirements, provide J. L. Industries, Inc., a division of Activar Construction Products Group; Model 1016F17.

B. Cabinet Construction: Nonrated or fire rated as indicated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless-steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless-steel sheet.

G. Door Style: Center glass panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: As indicated on Drawings.

K. Materials:

1. Stainless Steel: ASTM A 666, Type 304.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide inside latch and lock for break-glass panels.
3. Fire-Rated Cabinets:

    a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Knocked-down corridor lockers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal locker.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
2. Provide product literature for accessible lock and handle that show compliance with 2013 California Building Code.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.
4. Accessible Lockers: Clearly identify accessible lockers, heights to operable parts, and type of lock and handle provided.

C. Samples: For each color specified, in manufacturer's standard size.

D. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Identification plates.
b. Hooks.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of wood bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines Chapter 11B of the 2013 California Building Code (CBC), and ICC A117.1.

2.3 KNOCKED-DOWN CORRIDOR LOCKERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. ASI Storage Solutions Inc; Traditional.
2. Lyon Workspace Products, LLC; Standard.
3. Penco Products, Inc; Guardian.
4. Republic Storage Systems Company; Quiet.

B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
3. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
4. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
5. Door Style: Vented panel as follows:

    a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.

D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

F. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

G. Accessible Door Handle and Latch:

1. Provide door handle and latch that complies with 2013 California Building Code section 11B-309 and are operable with one hand and do not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds of force.

~~G.~~H. Locks: Combination padlocks.

1. Accessible Lockers: Provide keypad access.

~~H.~~I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

~~I.~~J. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.

~~J.~~K. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet. Provide unless shown otherwise.

1. Height: ~~4~~6 inches.
2. Anchorage: Provide for expansion bolt connection to concrete.

~~K.~~L. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.

1. Closures: Vertical -end type.
2. Sloping-top corner fillers, mitered.

~~L.~~M. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet.

~~M.~~N. Materials:

1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.

~~N.~~O. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
3. Triple-Tier Units: One double-prong ceiling hook.

D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

H. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
2. Provide ~~toothed steel or lead expansion sleeves~~for Hilti TB-TZ anchors for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

3.3 ADJUSTING

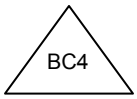
A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113



SECTION 110001 – MISCELLANEOUS EQUIPMENT
(This section Added in its entirety in BC 4)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Miscellaneous equipment, including:

1. Coordinate installation of Owner-furnished, Owner-installed equipment.
2. Coordinate installation of required backing and anchorage for Owner-installed equipment.
3. Furnish and install Contractor-furnished equipment.
4. Install Owner-furnished equipment.

B. Related Sections:

1. Backing: Sections 055000 and 0929000.
2. Installation of Mechanical Equipment: Refer to Mechanical Drawings:
3. Electrical Work: Refer to Electrical Drawings.

1.2 SUBMITTALS

A. Submit shop drawing, manufacturer's technical data and material specifications, and samples, as applicable, for Contractor-furnished and Contractor-installed products specified herein for Owner's Representative’s review prior to start of Work in this section.

1.3 MANUFACTURE

A. Products specified herein are intended for use by Owner. In the event Owner selects other products, revise openings, utility hookups, backing, etc., as required.

1.4 SHOP DRAWINGS OF OWNER-FURNISHED EQUIPMENT

A. Review drawings and catalog cuts of Owner-furnished equipment to verify dimensions, etc. Report conflicts between these drawings and contract drawings to Owner's Representative.

1.5 SPECIAL REQUIREMENTS

A. Verification of Conditions: Verify dimensions and conditions in the field. Inspect related work and adjacent surfaces. Report in writing inaccuracies and conditions which prevent proper installation of this work. Report in writing any discrepancies between anchorage designed for equipment and equipment limitations or restrictions which would affect anchorage.

B. Equipment hookups shall conform with applicable portions of local governing authorities requirements, such as plumbing, electrical, UL requirements, NFPA, etc.

C. If specified models are discontinued, Owner and Contractor shall provide manufacturer's updated model. Coordinate required changes to backing and hook-ups.

D. Protect equipment from damage resulting from work of other trades. Repair or replace damaged equipment, as directed by Owner's Representative, at no additional cost to Owner.

1.6 DEFINITIONS AND ASSIGNMENT

A. This section defines responsibilities related to equipment shown on drawings and assigns contractual responsibility for such equipment items.

B. Equipment responsibilities are furnishing and installation of equipment described in this section of specifications.

C. Contractor shall provide necessary utilities and make final hook-ups to equipment described in this section.

D. Contractor shall provide necessary structural support and attachments (not otherwise provided) for equipment described in this section.

E. Contractor shall furnish items of equipment as indicated in this section.

F. Contractor shall install items of equipment as indicated in this section.

G. Owner shall furnish items of equipment as indicated in this section.

1.7 RESPONSIBILITIES DESCRIBED

A. Assignment to Contractor of equipment responsibility shall require Contractor to perform following work:

1. Verification of utility requirements for equipment items.
2. Provision of utility rough-ins for equipment items, where required, unless specifically noted otherwise.
3. If Owner substitutes item similar to that specified, there shall be no change in rough-in cost unless substitution occurs after rough-in is completed or rough-in involves other utilities or capacity different from that required by item originally specified.

B. Contractor furnished equipment is purchased by the Contractor.

C. Owner-furnished equipment is purchased by Owner.

1. Owner will:

a. Furnish standard integral parts of equipment.
b. Tailgate-deliver items to site.

2. Contractor shall:

a. Provide delivery dates of equipment to Owner for coordination with construction schedule.
b. Receive item at site and give written receipt for item at time of delivery, noting visible defects or omissions; if such declaration is not given, Contractor shall assume responsibility for such defects and omissions.
c. Store item until ready for installation.
d. Uncrate, assemble and set item in place.
e. Install items in conformance with manufacturer's recommendations, instructions and shop drawings under supervision of manufacturer's representative, supplying labor and material required and making mechanical, plumbing and electrical connection necessary to operate equipment.
f. Provide structural support, connection bracing, hangers, seismic clips, etc., for proper installation of equipment.
g. Dispose of equipment crates, cartons, packing materials and other debris resulting from unpacking Owner's equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall conform with the following requirements and shall be of new stock of the highest grade available, free from defects and imperfections, of recent manufacture and unused. Where two or more identical articles or pieces of equipment are required, they shall be of the same manufacturer. Where model numbers are indicated, and specified models are discontinued, the Contractor shall furnish the manufacturer's updated model at no additional cost to the Owner.

2.2 EQUIPMENT LIST LEGEND (Refer to Equipment Schedule)

A. OFCI - Owner Furnished Contractor Installed.

B. OFOI - Owner Furnished Owner Installed (also called out as N.I.C. items). General Contractor to provide rough-in utilities and/or backing as shown on plans and specifications for these items.

C. CFCI - Contractor Furnished Contractor Installed.

D. OFVI - Owner Furnished Owner's Vendor Installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in conformance with drawings and manufacturer's instructions by installers trained and approved by manufacturer.

END OF SECTION 110001

SECTION 115223 - AUDIO-VISUAL EQUIPMENT BRACKETS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Mounting hardware for monitors.

B. Related Sections include:

1. Section 055000 "Metal Fabrications" for miscellaneous framing and support members for equipment brackets.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: For each type of bracket and mounting device, indicating mounting plates, fasteners, extension hardware, and method of attachment to structure.

C. Verify Owner-selected audio-visual unit sizes and loads prior to ordering.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain television mounting brackets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 RECESSED MONITOR WALL MOUNTING BRACKET

A. Basis-of-Design Product: Subject to compliance with requirements, provide MSTU Fixed Wall Mount, Thinstall Series; Chief Professional AV Solutions.

B. Accessories: Provide accessories as required for the attachment of brackets to structural support for the following applications:

1. Wall Mounting: Provide bracket manufacturers standard anchors and wall backup plates for bracket model and weight of equipment recommended by manufacturer for substrate conditions.
2. In-Wall Box with Power Outlet Conditioner: Coordinate installation with Division 26 sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install audio-visual mounting hardware where indicated. Secure to structure in strict accordance with manufacturer's instructions.

3.2 PROTECTING AND CLEANING

A. Protect equipment after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION 115223

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single and double rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Refer to Interior Design Drawings for Basis-of-Design roller shade manufacturer and product information. Provide roller shade product listed there.

B. Source Limitations: Obtain roller shades from single source from single manufacturer who will furnish and warrant hardware and components that have been designed and tested as a compatible and integrated system.

2.2 MANUALLY OPERATED SHADES WITH SINGLE AND DOUBLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: As indicated on Drawings.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: As indicated on Drawings.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Mounting Configuration: As indicated on Drawings.
2. Inside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back of roller.

3. Outside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back of roller.

4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Outside Shadebands:

1. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: As indicated on Drawings.
b. Color and Finish: As indicated in Interior Design Drawings.

E. Installation Accessories:

1. Endcap Covers: To cover exposed endcaps.

2. Installation Accessories Color and Finish: As indicated in Interior Design Drawings.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plastic-laminate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in plastic-laminate countertops.
2. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For the following:

1. High-pressure decorative laminate.
2. Adhesives.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of fabrication.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program, or will furnish a WI Certified Compliance Tracking Acknowledgement with the original submittals, and arrange for inspection by a WI Inspector after completion of installation.

C. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards," latest edition, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that countertops, including installation, comply with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Basis-of-Design Products: Refer to Interior Design Drawings for basis-of-design high-pressure decorative laminate manufacturer and product information, including colors and patterns. Provide high-pressure decorative laminate from manufacturers listed there.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Refer to Interior Design Drawings for basis-of-design high-pressure decorative laminate colors and patterns.

E. Edge Treatment: As indicated, of 3 mm PVC edge banding.

F. Core Material: Exterior-grade plywood.

G. Core Material at Sinks: or exterior-grade plywood.

H. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1.

2.3 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.4 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which Work will be applied, and verify the adequacy and location of required backing or support framing.

B. Verify dimensions where fabricated materials are required to conform to and fit adjacent building surfaces.

C. Correct unsuitable conditions before proceeding with installation.

3.2 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.3 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.
3. Install laminated plastic in long lengths with as few joints as possible. Joint other than hairline at all locations will not be acceptable.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c.and to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.
2. Quartz agglomerate countertops and backsplashes.

B. Related Sections:

1. Section 092216 "Non-Structural Metal Framing" for metal bracing, blocking, and backer plates required for installing countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.
3. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style as indicated in Interior Design Drawings.

B. Countertops: 3/4-inch- thick, solid surface material.

C. Backsplashes: As indicated.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style as indicated in Interior Design Drawings.

B. Countertops: 3/4-inch- thick, quartz agglomerate.

C. Backsplashes: As indicated.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

2.3 COUNTERTOP MATERIALS

A. Particleboard: ANSI A208.1.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Basis-of-Design Products: Refer to Interior Design Drawings for basis-of-design solid surface manufacturer and product information, including colors and patterns. Provide solid surface material from manufacturers listed there.
2. Type: Provide Standard Type unless Special Purpose Type is indicated.

D. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

1. Basis-of-Design Products: Refer to Interior Design Drawings for basis-of-design quartz agglomerate manufacturer and product information, including colors and patterns. Provide quartz agglomerate from manufacturers listed there.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 130808 - MRI FERROMAGNETIC DETECTION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ferromagnetic Detection System for staff/patient screening at MRI suite.

1.2 SYSTEM DESCRIPTION

A. Design Requirements

1. Magnetic Field: Provide ferromagnetic detection instruments capable of functioning without producing any static or time varying magnetic field.
2. Alarms: Provide ferromagnetic detection instruments with auditory and visual alarms.

    a. The ferromagnetic detector will react only to metals attracted to a DC magnetic field.
    b. The detector Alarm lights will show location of the ferromagnetic threat.

3. Mounting Requirements: Ferromagnetic detection equipment can be mounted internal (for out-swing doors) or external (for in-swing doors) to the MRI room.
4. Alarm Visibility: Visual pre-warning alarms, location indicators and bar graphs must be visible simultaneously both inside and outside the magnet room

B. Performance Requirements:

1. Alarm audio and visual signals activate upon detection of ferromagnetic materials of a mass, orientation and distance as prescribed by the specifications of the individual instrument.

    a. Visible Alarm: Provide visual alarm with dual bar graph displays that change in real time without activation of the audible alarm in order to differentiate the degree of ferromagnetic material detected prior to entering the detector. Provide escalating visual advance warning.
    b. Audible Alarm: Provide audible alarm triggered by the interruption of an optically coupled beam between the two sides of the detector portal.
    c. Threat Location indicator: Visually pinpoint the location of the ferromagnetic object to within 1 of 18 zones within the portal

2. Non-ferromagnetic materials which do not come into contact with the detector will not activate the alarms.
3. Provide the ferromagnetic detector the ability to manually increase or decrease sensitivity levels of detection.
4. Provide the ferromagnetic detector with the ability to be configurable for differing width coverage.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on all products, including:

1. Site preparation instructions and recommendations.
2. Design precautions for mitigation of interference sources.

B. Shop Drawings:

1. Dimensional Drawings: Ferromagnetic Detector, Power Supply & Accessories showing layout, profiles and product components, including anchorage (if required).
2. Wiring Diagrams: Showing requirements for electrical power, routing of power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field Installation Quality-Assurance Reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Operation Manual and maintenance data for installed products.

B. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: Manufacturer capable of providing field installation services for ferromagnetic detection portals during start-up operations.

C. Source Limitations: Obtain ferromagnetic detection system from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Pre-installation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE & HANDLING

A. Store products in manufacturer's unopened packaging prior to installation.

B. Dispose of waste crating, packaging and shipping materials following manufacturer installation.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Maintain temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's limits.

B. Verify project conditions: Notify the Architect if such conditions are not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design:

1. Provide Wall-Mounted Portal FerrAlert HALO II by Kopp Development Inc.

2.2 MRI FERROMAGNETIC DETECTION SYSTEM

A. Ferromagnetic Detection Systems:

1. Provide system consisting of a portal containing 2 vertical sections.
2. The vertical sections have 12 green NORMAL indicators, 48 red ferromagnetic threat location indicators.
3. The connecting crossbar contains 2 magnitude indicator bar graphs,
4. a pre-alarm beacon and audible alarm.
5. The portal is powered by a SELV (safe extra low voltage) power supply interconnected via a low voltage cable either surface mounted or routed within electrical rough-in at either side and adjacent to the portal or doorway to be guarded and a power supply which is to be located above the dropped ceiling if local electrical codes permit or surface mounted under the cover provided by the manufacturer Kopp Development Inc.
6. Locations: Refer to drawings for equipment location(s), including installation heights, and quantity.
7. Finishes: Standard finish is pearl white.

8. Operation Mode: Portal is generally located on the door frame between zone III and zone IV (magnet room). If a large ferromagnetic object approaches the ferromagnetic detector portal, the entire array of 48 red alarm lights flash well ahead of the entrance to the detector portal. If a moderate size object approaches the detector portal, the yellow pre-warning beacon located in the crossbar will illuminate also ahead of the entrance to the portal. Should a ferromagnetic object of sufficient mass continue into the portal, all of the 48 red lights will flash momentarily. The lights will converge on the location of the ferromagnetic threat. At the same time as the red lights are flashing an audio alarm will sound.

B. Provide manufacturer's standard installation kit. Kit to consist of the following:

1. 1 each: Power supply (Input 240VAC/120VAC, Output +/-15V DC) w/ power cords
2. 1 each: door switch kit (for out-swing door installations)
3. 1 each: hardware and bracket kit
4. 1 each: Operation manual and other installation documents

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:

1. Verify substrate and worksite conditions meet or exceed manufacturer's requirements for installation.
2. A Request for installation (RFI) will be executed.

3.2 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Conduct the pre-installation steps in accordance with the manufacturers written instructions.

3.3 INSTALLATION

A. Installation to occur after all wet work is complete and staff is available for training.

B. Approved installer to install wall mounted ferromagnetic detection systems in accordance with manufacturer's written instructions.

C. Install secure, plumb, level and true to line free of rack in its permanent location.

D. Detector is to remain powered off until training day.

3.4 FIELD QUALITY CONTROL

A. Functionality and performance testing will be conducted by the manufacturer approved installer according to manufacturer's procedures.

B. Prepare test and inspection reports as follows.

1. A three stage process consisting of installation, verification/testing and staff training by the manufacturer-approved installer.

3.5 CLEANING

A. Cleaning:

1. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products.
2. Clean all installed products in accordance with manufacturer's instructions.
3. Remove and legally dispose of construction debris from project site.

3.6 PROTECTION

A. Protect installed products including wiring and devices until Owner takes possession.

END OF SECTION

SECTION 130950 - RADIO FREQUENCY SHIELDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section includes furnishing all labor, materials, equipment, tools, and related items to provide, fabricate, deliver and test all radio frequency shielding for the MRI Scan Room as shown on the drawings as specified herein.

1.2 WORK NOT INCLUDED

A. The following work is not included in this section of the specification, but this work shall be coordinated with the RF shielding manufacturer.

1. All electrical connections to the RF filters.
2. Any ductwork to and from the waveguide type RF air vents.
3. Any piping to and from the RF penetrations.
4. Field painting and/or any other final finishes.
5. Any construction work in connection with conventional construction enveloping the shielded rooms. Preparing surfaces to receive the RF shielded environment.
6. Any filtering for penetration or set up panels, RF signals and/or related imaging equipment.
7. The MRI Scan Room area must be weatherproofed prior to installing the RF enclosure. The concrete slab must be cured and heated to a minimum of 68 F degrees prior to installing the floor shielding.

1.3 SUBMITTALS

A. Submit shop drawings for approval prior to fabrication. Shop drawings shall reflect the typical floor plan, elevation of the enclosure, typical construction sections, locations of miscellaneous penetrations and any other condition which will affect the shielded enclosure.

1.4 APPLICABLE STANDARDS

A. The following codes and standards of the issue listed below form a part of this specification, and where referred to are applicable to the extent indicated.

1. MIL-STD-285: Method of attenuation Measurements for Electromagnetic Shielding Enclosures for Electronic Test Purposes.

2. MIL-STD-220-A: Method of Insertion Loss Measurements for Radio Frequency Filters.
3. NSA 65-6 - RF shielded enclosures for communication equipment: General Specifications.
4. FEDERAL SPECIFICATION SS-A-118B - Flame resistance test.
5. ASTM E-84-81A - Test for surface burning characteristics of building materials.
6. U.L. 1283 - Standard for safety-electromagnetic interference filters.
7. ASTM E90-83 - Recommended practice for laboratory measurements of airborne sound transmission loss of building partitions.
8. ASTM E413-73 - Standard classification for determination of sound transmission class.

1.5 GUARANTEE

A. Guarantee enclosure against defective materials and workmanship and to retain the specified radio frequency shielding characteristics for a period of five years from date of acceptance test; filters, door system and all moving parts for a period of one year.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. All enclosures shall be equal to those supplied by Braden Shielding Systems, 9260 Broken Arrow Expressway, Tulsa, Oklahoma, 74145; (918) 624-2888.

B. Other enclosures are acceptable provided two layers of shielding are provided in all walls, floors, and ceiling.

C. Steel is the preferred shielding material due to it's higher performance, other mediums are acceptable provided they meet MRI vendors performance requirements.

1. The manufacturers must have been engaged in the manufacture and installation of RF shielded enclosures for a minimum of five years.
2. The submittal shall include a list of at least 10 successful installations of similar complexity and size. Test results from those sites shall also be included.

2.2 RF SHIELDING - SOLID CORE MODULAR PANEL SYSTEM

A. The basic enclosure shall be constructed to the proper dimensions consisting of pre-engineered modular panels and their related framing system.

B. Wall, floor and ceiling panels: All shield panels shall be rigid structural panels, faced on both the interior and exterior sides with fully galvanized 28 gauge steel skins. Provide necessary attachment channels for the application of interior furring studs.

C. Panel interlocking system: Shall consist of 11 gauge pre-engineered zinc plated metal framing members. No rigid solder seams shall be permitted. The framing element shall consist of shapes which will provide a clamping action on both the interior and exterior panel edges. A uniform and constant pressure contact shall be maintained against the entire perimeter of each shielded panel.

D. Trihedral corners are to be framed with machined cast bronze corner cap assemblies.

E. Fasteners used within the framing system shall be hardened steel, self-tapping TORX head screws set at 90 inch pounds of torque and spaced on 4" centers for the entire perimeter of all shielded panels.

F. Floor System:

1. Magnet room floor systems shall be dual skinned galvanized steel with zinc plated framing.
2. Fasteners: All fasteners utilized within the floor system shall be flat head TORX head screws mounted within the framing system. Each unit set at 90 inch pounds of torque on 4" centers.

2.3 GENERAL

A. In no case shall any fastening system be employed that utilizes screws, nails or other projections through the shield medium. On dual skin panels, items may be mounted directly to the interior skin face as long as the mounting mechanism does not penetrate the exterior skin and proper mounting techniques are utilized.

2.4 RF SHIELDED DOOR

A. The RF shielded door assembly shall provide full RF integrity while presenting the appearance of a conventional door.

1. Door Leaf: Shall consist of a solid core, plastic laminated leaf with full perimeter brass contact strip. The leaf shall be hung from three (3) radial thrust bearing hinges. One layer of fully annealed copper sheet shall be laminated to the exterior surface of the leaf and electrically bonded to the perimeter brass contact strip to provide the RF shielding effectiveness. A user serviceable brass contact strip with integral beryllium copper contact fingers shall be attached to the leaf bottom.
2. Door Latch: To consist of a standard hardware Schlage, Model ND70PD RHO 626 Classroom lock. Door handle shall provide a smooth quick door seal with not more than 20 pounds pressure. A pressure of no more than 20 pounds of force shall release the door. Door shall not require slamming to close or excessive force to open.
3. Door will have automatic door opening system complying with low power energy standard.
4. Jamb: Shall consist of kiln dried dimensioned oak directly mounted to dual skinned panels.

5. RF Contact Fingers: Shall consist of a single row of heavy duty beryllium copper alloy spring temper contact finger strips. Contact strips shall be compression mounted to the interior side of the door jamb. This mounting location will ensure protection of the contact fingers from the passage of cryogen dewars, carts and equipment. All contact fingers are to be user serviceable and repairable.
6. Threshold: Shall consist of a solid brass, tapered ramp mounted directly into the shielded door jamb. This brass sill shall provide the necessary RF seal. The RF contact fingers shall be mounted to the bottom of the door leaf.
7. Floor Coverings: Due to the inherent design of RF shielded doors, acceptable finish floor coverings shall not exceed 1/8" in total thickness.
8. STC rating: 40.

2.5 RF SHIELDED WINDOW OPENING

A. RF Windows: Shall consist of a double layer of RF shielding conductive mesh material. The RF shielding effectiveness of the shield shall not be degraded by this window.

1. STC rating: 40.

2.6 RF SHIELDED ACCESSORIES

A. Filters: Shall provide an attenuation which is satisfactory for the intended application and be mounted on the service panels. Electrical conductors shall pass through waveguide fittings which are an integral part of the filter. A means of securing the filter to the service panel shall be an integral part of each filter.

B. Waveguide Air Vents: Shall be used to supply intake and exhaust air to provide necessary ventilation. Each ventilator shall be of the waveguide below cut-off type. Vents shall be 3/16" steel hex cell 1" deep.

C. Feed Thru Connector Assemblies: Shall be coaxial feed thru connectors which shall be mounted to removable brass service panels. Set up panels shall conform to requirements of the MRI equipment manufacturer.

D. Grounding:

1. Single Point Service Ground: Shall be accomplished with a 1/2" diameter threaded solid brass grounding stud on the service panel. The standard method of grounding shall consist of connecting exterior and interior shields at one point on the service panel to achieve a single point.
2. Equipment Grounds: Grounding for the superconducting magnet and RF front end shall be as required by the MRI equipment manufacturer.

E. Mechanical Penetrations: Shall be RF shielded waveguide type nonferrous pipe penetrations for all pipes entering the shielded enclosure.

F. Removable Magnet Access Panels: Shall be provided as indicated on the contract drawings.

2.7 RADIO FREQUENCY SHIELDING PERFORMANCE

A. The function of RF construction is to permit an interference free environment with a single ground point using industry standard construction techniques.

B. For this purpose the interference free environment must meet these minimum functional requirements:

1. Attenuation to Magnet Field: As required by the magnet supplier.
2. Attenuation to Electric Field: As required by the magnet supplier.
3. Attenuation to Plane Waves: As required by the magnet supplier.
4. The environment must be constructed ungrounded with a minimum resistance to ground of 1,000 ohms.

PART 3 - EXECUTION

3.1 COORDINATION

A. Refer to mechanical, electrical and plumbing drawings for utility penetrations of the shielding.

B. Items furnished by other sections for installation into the work of this section shall be installed in accordance with the requirements of such other sections, providing such requirements do not violate the shield.

C. Items furnished by this section for installation into the work of other sections shall be furnished sufficiently early to the proper section for timely installation.

D. Perform work for this section in proper sequence with the work of other sections and trades and in strict conformance with the approved shop drawings.

E. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades that interface with the work of this section.

3.2 INSPECTION

A. Shielding contractor shall examine the areas and conditions under which the RF shielded enclosures are to be installed and notify the Architect in writing of conditions detrimental to the proper and timely completion of work. Work shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the shielding contractor.

B. Floor substrate shall be leveled to a tolerance of 1/8" in 10 feet by the general contractor. Slab area at the patient entrance door and all other RF doors shall be rendered flat and true with no greater than 1/16" deviation in levelness on 8 feet within the door swing area.

3.3 INSTALLATION

A. Refer to shop and erection drawings for location, type and thickness of shielding materials.

B. Shielding shall be continuous within its limits, with electromagnetically tight seams; where other work, materials or accessories penetrate the shielding, install shielding patches or sleeves or provide continuity of the shielding.

C. Installation shall be by the manufacturer's certified field service technicians.

D. Prefabricated floor panels shall be laid on 6 mil, vapor barrier, dielectric film placed on the structural floor of the parent room before any other work is placed thereon. Over this film additional dielectric filler material shall be furnished as required, to provide uniform ungrounded support for the panels.

E. All panels shall be laid in a straight line with true level and even surfaces, and the joints shall be in alignment. Exposed surfaces shall be thoroughly cleaned of all dirt, finger marks and foreign matter resulting from handling or installation, and all areas shall be left free from defects.

F. At completion of installation, provide identification of magnet isocenter location.

3.4 FIELD QUALITY CONTROL

A. The enclosure shall be tested for isolation from ground during construction, and for RF shielding upon completion as described below:

B. A system ground alert alarm (audio and visual) will be utilized continuously during construction to ensure the shielding system is electrically isolated from ground. Upon activation of the grounding alarm, the shielding contractor will investigate the cause of the grounded condition and rectify it bringing the system to 1000 ohms above ground, if the ground was caused by actions of the shielding contractor. However, if the ground was caused by the actions of others, then the shielding contractor shall notify the Architect and advise what actions should be taken to rectify the ground condition.

C. The shielded enclosure is to be tested in accordance with MIL-STD-285, modified to demonstrate the shielding effectiveness required by the MRI system supplier. Two tests will be required as described below:

1. Qualification Test: Will be performed after the enclosure is installed and before any other finishes or building construction is erected within the shielded enclosure.
2. Acceptance Test: Will be performed after completion of the room, just before occupancy of the owner and prior to magnet ramping.

D. Submit certified test results. Each test must be witnessed by representatives of the owner, architect and/or magnet manufacturer.

E. Testing shall be as follows:

1. Magnetic Field - Per MIL-STD-285 and MRI System requirement.
2. Electric Field - Per MIL-STD-285 and MRI System requirement.
3. Plane Wave - Per MIL-STD-285 and MRI System requirement.
4. Test All: Seams, windows and doors.
5. Modify minimum attenuation specifications per the installed magnet vendor.

F. Continuously test the system for isolation from grounding during construction, and for RF shielding upon completion as described above by means of a ground alarm system.

3.5 CLEANING

A. Immediately remove all spots, smears, stains, residues, adhesives, etc., from the work of this section and/or upon adjacent areas or surfaces which result from the work of this section.

B. Upon completion of the work of this section, dispose of all debris, trash, containers, residue, remnants and scraps which result from the work of this section.

3.6 PROTECTION

A. Exercise care in handling and protecting materials and finishes during fabrication, shipment, erection and finishing, as necessary to prevent damage to finished surfaces and shielding linings.

B. Protect work of this section against damage. Should damage occur prior to substantial completion of the work, it shall be removed and replaced at no additional expense to the owner.

END OF SECTION 130950

SECTION 134900 - RADIATION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Lead sheet, strip, and plate.
2. Lead-lined gypsum board.
3. Lead glass.
4. Lead glazing plastic.
5. Lead-lined, hollow-metal doors and door frames.
6. Modular shielding partitions.
7. Informational signs.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for steel framing members for bracing lead-brick wall shielding.
2. Section 087100 "Door Hardware " for door hardware for lead-lined steel hollow-metal doors.
3. Section 092900 "Gypsum Board" for metal framing and furring for lead-lined gypsum board and for finishing materials, accessories, and trim applied to lead-lined gypsum board.
4. Section 099113 "Interior Painting" for field finishing doors and frames.
5. Division 26 Sections for electrical connections including conduit and wiring for neutron-shielding door controls and operators.

1.3 DEFINITIONS

A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to radiation protection including, but not limited to, the following:

a. Sequence and schedule of radiation protection work in relation to other work.
b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
c. Methods of attaching other construction and equipment to lead-lined finishes.
d. Notification procedures for work that requires modifying radiation protection.
e. Requirements for field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.

1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Product Schedule: For observation windows, doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For neutron-shielding doors to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Testing Agency Qualifications: Licensed by authorities having jurisdiction to perform radiation shielding surveys.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

B. Lead-Lined, Hollow-Metal Doors and Frames: Comply with requirements in Section 081113 "Hollow Metal Doors and Frames" for delivery, storage, and handling.

C. Lead-Lined, Hollow-Metal Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided the refinished repair matches new work and is approved by Architect; otherwise, remove and replace damaged items as directed.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.

1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.

B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

D. Fire-Rated and Smoke-Control Door and Frame Assemblies: Comply with Section 081113 "Hollow Metal Doors and Frames".

2.2 MANUFACTURERS

A. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.

2.3 MATERIALS

A. Lead Sheet, Strip, and Plate: ASTM B 749, Alloy UNS No. L51121 (chemical-copper lead).

B. Lead Glass: Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:

    a. Amerope Enterprises, Inc.
    b. McGrory Glass, Inc.
    c. Radiation Protection Products, Inc.
    d. Schott North America, Inc.

2. Safety Glass: Laminated glass. (GL-7)

    a. Outer Ply: Clear float glass.
    b. Interlayer: Clear polyvinyl butyral.
    c. Inner Ply: Lead glass; 4 PSF; 1/16-inch lead equivalency.
    d. Overall thickness: 1/2-inch.

3. Safety Glass: Laminated glass with one way glazing ply. (GL-8)

    a. Outer Ply: 1/4-inch thick grey tinted glass.

        1) Basis-of-Design Product: Mirropane; Pilkington North America, Inc.

    b. Interlayer: Clear polyvinyl butyral.
    c. Inner Ply: Lead glass; 4 PSF; 1/16-inch lead equivalency.
    d. Overall thickness: 1/2-inch.

C. Lead Glazing Plastic: Transparent acrylic sheet impregnated with an organolead compound and containing 30 percent lead by weight.

1. Manufacturers: Subject to compliance with requirements, provide the following:

    a. Fluke Biomedical; Radiation Management Services.

2. Thickness: As needed to provide lead equivalence indicated.

D. Glazing Compounds, Gaskets, and Accessories: Comply with requirements in Section 088000 "Glazing."

E. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

F. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

G. Asphalt Felt: ASTM D 226/D 226M.

2.4 LEAD-LINED, HOLLOW-METAL DOORS

A. General: Steel doors complying with NAAMM-HMMA 861, except with a single continuous sheet of lead of thickness as indicated on Drawings extending from top to bottom and edge to edge, installed either between back-to-back stiffeners or between stiffeners and stop face of door.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A & L Shielding, Inc.
    b. Deronde Products.
    c. Karpen Steel Custom Doors & Frames.
    d. New Shield.
    e. Ray-Bar Engineering Corp.

2. Line inverted channels at top and bottom of doors with lead sheet of same thickness used in door and close with filler channels to provide flush top and bottom edges.
3. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining 1 inch.
4. Prepare doors to receive observation windows; cut and trim openings through doors in factory. Furnish removable stops for glazed openings.
5. Factory fit doors to suit frame-opening sizes indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom.
6. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.5 LEAD-LINED, HOLLOW-METAL DOOR FRAMES

A. General: Steel door frames complying with NAAMM-HMMA 861, except 0.0667 inch thick, lined with lead sheet of thickness not less than that required for doors and walls where frames are used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aaccurate Radiation Shielding, Inc.
b. A & L Shielding Inc.
c. Deronde Products.
d. El Dorado Metals, Inc.
e. Fluke Biomedical; Radiation Management Services.
f. Karpen Steel Custom Doors & Frames.
g. Mayco Industries; a Metalico company.
h. NELCO, Inc.
i. New Shield.
j. Radiation Protection Products, Inc.
k. Ray-Bar Engineering Corp.

2. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.6 LEAD-LINED MODULAR SHIELDING PARTITIONS

A. General: Partial-height modular partitions assembled from factory-finished standard components consisting of lead-lined, enameled-steel framing members; lead-lined opaque panels; lead glazing plastic vision panels; and hardware necessary for assembly and for securing to other construction. Fabricate opaque panels from honeycomb-core metal panels with polyurethane paint finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aaccurate Radiation Shielding, Inc.
b. A & L Shielding Inc.
c. Fluke Biomedical; Radiation Management Services.
d. New Shield.
e. Radiation Protection Products, Inc.
f. S&S Technology; S&S X-Ray Products.

2. Lead Equivalence for Opaque Panels: 1.5 mm.
3. Lead Equivalence for Framing Members: 1.5 mm.
4. Lead Equivalence for Vision Panels: 1.5 mm.

2.7 INFORMATIONAL SIGNS

A. Informational Signs: Comply with Section 101423 "Panel Signage."

1. Color: As selected by Architect from manufacturer's full range of colors.

2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
3. Indicate lead equivalence in millimeters and heights of radiation protection in inches (millimeters).

2.8 DOOR AND DOOR FRAME FABRICATION

A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Surfaces: Proceed with installation only after concrete surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

3.2 INSTALLATION, GENERAL

A. Manufacturer's field representative shall assist in coordinating the work of the trades involved in the installation of its radiation protection products, and shall be available for consultation in the solution of problems encountered during installation.

3.3 INSTALLATION OF LEAD SHEETS IN CONCRETE FLOOR SLABS

A. Lead Sheet, 1/8 Inch Thick or Less: Install in a single layer with a 2-inch minimum lap at joints.

B. Lead Sheet More Than 1/8 Inch Thick: Install in two or more layers with a 2-inch minimum lap at joints, or in a single layer with joints butted and covered with a 4-inch-wide lead strip of same thickness.

3.4 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints. Install using construction adhesive and supplementary fasteners.

B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer.

1. Install lead strips covering face of framing and wrap around flange to cover points of screws. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

C. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Apply lead disks over screw heads and recess flush with surface of board.

1. Install lead strips, 1-1/2 inches wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at face of supports and blocking where joints do not occur.
2. Apply lead disks recessed flush with surface of board over heads of screws securing gypsum board and trim.

D. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

E. Finish lead-lined gypsum board to comply with Section 092900 "Gypsum Board."

3.5 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

A. Install lead-lined steel doors and door frames according to Section 081113 "Hollow Metal Doors and Frames."

B. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with door manufacturer's written instructions.

C. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.

1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
2. In metal stud construction, use wall anchors attached to studs with screws.

D. Lap lead lining of frames over lining in walls at least 1 inch.

E. Lead Lining of Frames: Line inside of frames with lead of thickness not less than that required in doors and walls where frames are used. Form lead to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 1 inch.

F. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.

G. Line astragals with lead sheet.

H. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 087100 "Door Hardware" for other installation requirements.

I. Touch up damaged finishes with compatible coating after sanding smooth.

J. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.6 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

A. Install observation windows according to manufacturer's written installation instructions.

1. Apply a coat of asphalt mastic or paint to lead lining in frames where lead comes in contact with masonry or grout.

B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.

C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

3.7 INSTALLATION OF LEAD-LINED MODULAR SHIELDING PARTITIONS

A. Install partitions after finishes are complete in spaces where partitions are located. Install according to manufacturer's written instructions and Shop Drawings.

B. Cut and remove wall base where modular shielding partitions meet other walls so partition fits tightly to wall.

C. Secure partition framing to floor with 1/4-inch expansion anchors 16 inches o.c., and fasten to walls and ceilings as indicated. Brace partitions with tie rods fastened to walls or ceilings as indicated.

3.8 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.

D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch. Wrap conduit with lead sheet for a distance of not less than 10 inches from box.

E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch.

F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches from point of penetration.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a registered radiation health physicist to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

3.10 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed, and limit access to only those persons performing work in the rooms.

END OF SECTION 134900

SECTION 211000 - COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Layout and install a complete hydraulically designed fire sprinkler and standpipe systems indicated herein and on Drawings to equal or exceed latest NFPA 13, NFPA 14 and in accordance with State Fire Marshal and Monterey County Fire Marshal requirements. See Architectural Drawings for tenant space occupancy uses. Design piping layout with minimal disruption of adjacent tenant spaces. Sprinkler piping shall be sized for wood ceiling construction where applicable.

B. There is no as built drawing available. Contractor is responsible to carefully site survey the field and create as built CAD drawings per site condition. Coordinate and obtain prior written permissions from hospital for the time and areas needed for the site surveys. Call any concerns to attention of Architect during bidding period.

C. Contractor can choose to reuse some of the existing sprinkler system piping/ fitting etc., as long as the testing results proof that the existing system is per NFPA requirement. Contractor is responsible to test existing portion of pipes/ fittings etc. that they plan to reuse for the new system per NFPA 13 requirement. Provide records of testing as part of the construction document.

D. System complete with equipment, piping and related appurtenances. In addition to items specifically indicated, provide miscellaneous items required to result in complete and operable system.

E. Verify electrical requirements of alarm valves, flow switches, valve supervision switches, alarm bells and pumps with electrical contractor.

F. Provide contacts and appurtenances for interface with Building Control System.

G. The contractor is reposonsible to temporarily relocate sprinkler heads and or proivde other protective systems in order to proivde full coverage during constructuion while ceiling area removed as part of the work coordination requirement.

H. Fire protection system to be designed, sealed, and signed by a California Licensed Professional Fire Protection Engineer.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: The Installer shall be experienced in design and installation of fire protection systems similar to that indicated for this Project and in obtaining design approval and inspection approval from authorities having jurisdiction.

B. The Design/Build Fire Protection Drawings and Calculations shall be sealed and signed by a California Licensed Professional Fire Protection Engineer.

C. Design Criteria:

1. Base the piping system and arrangement of heads upon architectural and structural considerations. All pipe sizes and number of heads to be used for each area or room shall conform to the requirements to the National Fire Protection Association Pamphlet 13 2013 edition.
2. Sprinkler head shall be in pendant position at suspended ceilings and in upright position at all other locations.
3. Where heads are located at suspended ceiling, spacing shall be as required by NFPA 13, except as follows: In all locations, sprinkler heads shall be equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights, and air diffusers. Provide uniform and repetitive pattern for each room. Locate by architectural ceiling plan where shown.
4. Center sprinkler heads on joints in acoustic tile or center in tiles in order to conform to above.
5. To comply with above it is under stood that maximum spacing allowed under Pamphlet 13 may not be achieved, nor is it required. Symmetry is required.
6. Base pressure for hydraulic design from city water main pressure.
7. Provide concealed type sprinkler heads in the following areas except where prohibited by code: Public areas, main corridors, gypsum board ceiling and as indicated on plans.
8. Provide high temperature sprinkler heads in all mechanical, telecom, electrical rooms, skylights and other areas as required per NFPA 13.
9. (As alternate) Provide double interlock preaction sprinkler systems in MRI and Angio Rooms.

D. Requirements of Regulatory Agencies: Type, size, arrangement and configuration shall be as approved by:

1. Monterey County Fire Marshal.
2. State Fire Marshal.
3. NFPA - National Fire Protection Association:

    a. 13 - Standards for Installation of Sprinkler System, 2013 Edition.
    b. 14 - Standpipes and Hose Systems, 2013 Edition.
    c. 2001 – Clean Agent Fire Extinguishing Systems.

4. CBC- California Building Code, 2013 edition
5. CFC – California Fire Code, 2013 edition

1.4 SUBMITTALS

A. Shop Drawings and Product Data:

1. Prior to obtaining approvals noted below, submit reflected ceiling scale drawings for Architect's review showing sprinkler heads in relation to lights, air diffusers, ceiling joints and tiles, speaker, TV outlets, medical gas outlets, and any other ceiling outlets or obstruction. Drawings submitted to Fire Marshal, etc., shall incorporate revisions required by this review.
2. The spacing and details of the supports, attachments, and bracing of fire sprinkler piping shall comply with the NFPA 13 as modified by the 2013 CBC Sections 1616A and SFM. Prior to installation submit to Architect six copies of Shop Drawings showing the location of all sprinkler heads, piping, bracing, hangers and anchors and all necessary Working Drawings showing complete details of the piping within the building. Drawings shall be submitted for review prior to commencement of any Work. The Drawings shall have been reviewed and approved by the Office of the Fire Marshal prior to submittal. Submit proof of their approvals.
3. Provide all necessary information to ceiling suspension work, to provide coordinated submittals.
4. Before receiving final approval of job, furnish written statement to the effect that the Work has been completed and tested in accordance with the accepted Drawings and Specifications.
5. Provide details and sections as required to clearly define design. Include a materials list describing proposed materials.

B. Product data shall include, but not be limited to the following:

1. Pipe, fittings and valves.
2. Water flow indicators.
3. Valve position monitor switches.
4. Pipe hangers and sway breaks.
5. Drains, test connections, and accessories.

C. Maintenance Material (Spare Parts):

1. Furnish a sprinkler cabinet containing the minimum number of extra heads and a wrench in accordance with the requirements of NFPA 13.

D. Operating Instructions:

1. Provide, next to sprinkler riser, a printed sheet protected by glass or transparent plastic cover, with brief instructions regarding all necessary aspects of sprinkler controls and emergency procedures.

E. Record Drawings:

1. See Section 017000.
2. During progress of Work, maintain accurate record of all changes made.

1.5 JOB CONDITIONS

A. In accordance with Section 014000 and the following.

B. Specifications and Drawings:

1. In case of conflict, the most stringent takes precedence.
2. For purposes of clarity, legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.
3. Exact routing of piping shall be governed by structural conditions, obstructions. Make use of data in Contract Documents. In addition, Architect reserves right, at no increase in Contract Sum, to make any reasonable change in location of fire protection items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Contractor to verify Architect's requirements in this regard prior to roughing-in.
4. Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the approximate location shown on plumbing Drawings.
5. Mounting heights of brackets, outlets, etc., as required.

C. Coordination:

1. Work out all "tight" conditions involving Work under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no increase in Contract Sum.
2. Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided by Contractor, his decision, if consistent with Contract Document requirements, shall be final.
3. Coordinate electrical interlocks of plumbing equipment with Division 26.
4. Provide templates, information and instructions to other Divisions to properly locate holes and openings to be cut or provided.
5. Not all offsets in piping are shown. Contractor shall decide which item to offset or relocate. Maintain required slope in piping.
6. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire protection installations.
7. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
8. Coordinate requirements for access panels and doors for fire protection items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section - Access Doors and Frames.

D. Large Scale Layout Drawings: In accordance with requirements of Section 013300, prepare large scale detailed layout Drawings showing locations of equipment, piping runs, and all other elements of fire protection systems provided under this Division. Include sections of all "tight" areas to show relative position and spacing of affected elements.

E. Equipment Rough-In:

1. Rough-in locations shown on Plumbing Drawings for equipment furnished by Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources:

    a. From Shop Drawings for Contractor furnished and installed equipment.
    b. From Architect for Owner furnished-Contractor installed equipment.
    c. From existing equipment where such equipment is relocated under this Contract.

2. Verify fire protection characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Architect and provide as directed at no increase in Contract Sum.
3. Make final connections.

F. Site Examination:

1. Refer to 1.2 B of this section..

G. Review of Construction:

1. Work may be reviewed at any time by representatives of Architect.
2. Advise Architect that work is ready for review at following times:

    a. Prior to backfilling buried work.
    b. Prior to concealment of work in walls and above ceilings.
    c. When all requirements of Contract have been completed.
    d. Neither backfill nor conceal work without Architect's consent.

3. Maintain on job a set of Specifications and Drawings for use by Architect's representatives.
4. Engineer will assist Architect with field review of construction, will inform Architect regarding progress and problems related to construction, and will endeavor to guard Owner against defective materials and faulty workmanship. Engineer's reviews will be periodic, depending upon nature of construction. Engineer is not required to perform extensive or continuous inspection, is not responsible for execution of Contract Documents by Contractor, nor is he responsible for construction methods, sequences, or safety precautions.

H. Schedule of Work:

1. In accordance with Section 013216 and as follows:
2. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.

3. In scheduling, anticipate means of installing equipment through available openings in structure.
4. Before making connections or doing any work which will interrupt existing services, notify Owner, in writing, twelve working days in advance and advise duration of interruption; perform such Work as quickly as possible and only at such times designated by Owner, refer to General Conditions.

1.6 WARRANTY

A. In accordance with Section 017836, and as follows.

B. Warranty all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for period of one year from date of filing of Notice of Completion.

C. Provide new materials, equipment, apparatus and labor to replace that determined by Architect to be defective or faulty.

D. This guarantee also applies to services including Instructions, Adjusting, Testing, Noise, Balancing, etc.

E. Furnish Manufacturers' standard Warranties in excess of one year.

1.7 PROJECT RECORD DOCUMENTS

A. In accordance with Section 017000, and as follows:

B. Keep up-to-date during progress of job, one set of reproducible and erasable transparencies of Plumbing Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines:

1. Exact location, type, and function of concealed valves and controllers.
2. Exact size, invert elevations and location of underground/floor piping.

C. Progress drawing set to be available for inspection by Architect or Construction Manager weekly.

D. Submit completed Drawings to Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe:

1. Below Grade: Wrapped ductile iron with PE tube or sheet.
2. Above Ground:

a. 2 inches and smaller: UL listed Schedule 40 black steel with Victaulic couplings and fittings with certain exceptions, such as reducer fittings, weld let fittings, non-full-length reducer fittings are not acceptable or approved equal.
b. 2-1/2 inches and larger: UL listed Schedule 10 black steel with Victaulic couplings and fittings with certain exceptions, such as reducer fittings, weld let fittings, non-full-length reducer fittings are not acceptable, or approved equal.
c. Sprinkler piping of a dry pipe system shall be galvanized. Schedule 40 minimum.
d. Piping exposed to outdoor shall be galvanized.
e. Sprinkler piping in MRI enclosure shall be non-ferrous type.

B. Valves and Piping Specialties: UL listed and Factory Mutual (FM) approved and State Fire Marshal listed. See Section 220528.

C. Sprinkler Heads:

1. Grinnell, Viking or Automatic Sprinkler Co.
2. Suspended ceilings in public spaces and corridors: Flush type. Locations to be approved in Submittal drawings. Provide coverplate color samples as a Submittal for review by Architect.
3. Suspended ceiling in staff areas: Pendant type. All areas not provided with flush type per 2.1 C 2 above. White finish.
4. Provide heads with appropriate temperature ratings.
5. Provide approved guards in mechanical rooms, electrical rooms, telecom rooms, elevator machine rooms and hoist ways, sprinkler heads located less than 7 feet-6 inches above finish floor and other areas where heads are subject to mechanical abuse.
6. Provide corrosion resistant sprinkler heads located in pool areas, pool mechanical rooms and outdoor.
7. Provide sprinkler head shield for sprinkler heads located in linen chutes.
8. Provide steel cabinet with additional heads in amounts of five percent to total of each type installed; and one wrench for each head type. Mount cabinet on wall where directed by Architect.

D. Flow Switches: Gamewell Model PRS, Grinnell F-620 or Notifier WFD, 115 volt AC with two normally open electrical contacts for connections, specified in Electrical Division, to fire alarm and annunciator systems, UL listed.

E. Valve Supervision Switches: Provide, on all valves as code required, a 115 volt electrical switch with one normally open contact which will automatically close when valve is closed; for connection, specified in Electrical Division, to fire alarm "trouble indicator light".

F. Alarm Bells: Grinnell Model A with A2 trim, 115 volt AC, or Notifier SUG.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Architect if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.2 FABRICATION AND INSTALLATION

A. In accordance with requirements and Standards of National Fire Protection Association.

3.3 GENERAL REQUIREMENTS FOR PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Whenever changes in sizes of pipe occur, make the change with reducing fittings as the use of bushings will not be permitted, except where permitted by NFPA for one size reduction only.

C. Support and brace all piping and equipment from building structure by means of hangers, inserts and other supports in accordance with the requirements of NFPA Pamphlet.

D. Fit drain valves, inspector's test valves, and control valves with enamel sign indicating their purpose and use.

E. Conceal all piping within the building construction except in spaces with no ceiling.

F. Install all piping to maintain required headroom and to not interfere with operation or maintenance of equipment.

G. Install systems to provide for complete drainage and testing. Coordinate with plumbing contractor for sprinkler system drain and test water flow requirement.

H. Extend drain and test pipes to locations shown or directed. Drain discharges shall be visible, either directly or through sight glass. Coordinate final termination with plumbing work in Division 22.

I. Provide systems with identification signs specified or required by code.

J. Locate extra sprinklers and sprinkler wrench cabinets as directed.

K. Provide inspectors test system having flow equivalent of one sprinkler head for each area requiring a water flow indicator.

L. Air test systems upon completion prior to hydrostatic test.

M. Exact head location subject to approval of Architect; provide extra heads if required to comply with above. Includes at exterior canopies.

N. Coordinate Work with other crafts. Where conflicts occur, relocated sprinkler piping.

O. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.

P. Sleeves are not required for core-drilled holes.

Q. Permanent sleeves are not required for holes formed by removable PE sleeves.

R. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of plumbing equipment areas or other wet areas 1 inch above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide annular clear space between sleeve and pipe or pipe insulation.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section - Joint Sealants for materials and installation.

S. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals.

T. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

U. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 078400 - Firestopping for materials.

3.4 INSPECTION

A. After completion of the fire protection installation and at the start of the guarantee period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of "Inspection Agreement", at no increase in Contract Sum, calling for four inspections of the sprinkler system during the guarantee year, plus the following maintenance to be performed during the course of the fourth inspection.

1. Operating of all control valves.
2. Lubrication of operating stems of all control valves.
3. Operating of electrical alarms.
4. Cleaning of alarm valves.
5. Lubrication of Fire Department hose connection inlets.

    a. Fill out "Inspection Agreement" in triplicate after each inspection and send copies to the Owner, Insurance Carrier and Fire Department.

3.5 FIELD QUALITY CONTROLS

A. In accordance with the following:

1. Automatic Sprinkler Piping in accordance with NFPA Standards: Upon completion and prior to acceptance of the installation subject the system to a hydrostatic pressure test with no visible leakage. Remove and replace all defects due to materials or workmanship occurring during this test and retest after corrections have been made.

    a. Prior to this test, notify the local Fire Department, the Architect and the Owner 48 hours in advance.
    b. Upon completion of inspections and tests, complete and sign a "Contractor's Material and Test Certificate" by the Contractor and any witnesses to the tests. Submit the original of the completed certificate to the Owner's Representative prior to acceptance of the system.

END OF SECTION 211000

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Conform to the requirements specified under Section 230500 - Basic HVAC Requirements.

C. Conform to all electrical requirements under Section 260500 - Common Work Results for Electrical.

D. Conform to all applicable rules and regulations of local and state agencies including:

1. California Fire Code, 2013
2. California Building Code, 2013
3. California Plumbing Code, 2013
4. State Fire Marshal Requirements
5. OSHPD Requirements
6. California Electrical Code, 2013
7. Title 24, Part 6, Energy Code 2013
8. Title 24, Part 7, State Elevator Safety Regulations
9. NFPA 101, Life Safety Code 2012
10. California Green Building Standards Code, 2013
11. California Mechanical Code 2013
12. California AB 1953 no lead law

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Unions and flanges.
6. Mechanical grooved pipe connection.
7. Escutcheons.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

B. Pipe tube and fittings furnished as part of fabricated equipment are specified as part of equipment assembly in other sections.

1.3 REFERENCES

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ANSI B16.3: Malleable Iron Threaded Fittings.
2. ANSI B16.4: Cast Iron Threaded Fittings.
3. ANSI B16.5: Pipe Flanges and Flanged Fittings.
4. ANSI B16.22: Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.
5. ANSI B16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
6. ASTM A53: Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
7. ASTM A74: Cast Iron Soil Pipe and Fittings.
8. ASTM A105: Forgings, Carbon Steel, for Piping Components.
9. ASTM A126: Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
10. ASTM A234: Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
11. ASTM B32: Solder Metal.
12. ASTM B88: Seamless Copper Water Tube.
13. ASTM B306: Copper Drainage Tube (DWV).
14. ASTM B813: Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
15. ASTM C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
16. AWS A5.8: Brazing Filler Metal.
17. CISPI 301: Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste, And Vent Piping Applications.
18. CISPI 310: Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

B. Order all copper, cast iron, steel, plastic pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size and name of supplier.

C. Manufacturers: Firms regularly engaged in manufacture of pipe, tube and fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

D. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

E. Before any polyethylene fusion welding is performed, the Contractor shall submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, and Section 192.285.

F. The Owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the Contractor shall be prevented from doing further welding on the project and all defective welds replaced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Except for hub-and-spigot, and similar units of pipe, provide end caps on each length of pipe and tube and take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.6 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, AWWA or CISPI specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

1.7 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working pressure ratings, except where otherwise indicated:

1. Water Distribution Systems, above ground: 250 psig.
2. Soil, Waste, and Vent Systems: 10-foot head of water.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section - Access Doors and Frames.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 Piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 Piping Sections for special joining materials not listed below.

2.3 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Underground Piping NPS 1-1/2 and smaller: Manufactured fitting or coupling.
2. Underground Piping NPS 2 and larger: AWWA C219, metal sleeve-type coupling.
3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC, PVC, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve; ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 UNIONS AND FLANGES

A. General: Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees.

B. 2-1/2 inches and smaller steel: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

C. 2-1/2 inches and smaller copper: ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

D. 3 inches and larger steel: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full-face gaskets. Use ANSI B16.1 flat face flanges with full-face gaskets for mating with other flat face flanges on equipment.

E. 3 inches and larger copper: ANSI B15.24 Class 150 cast bronze flanges with full-face gaskets.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 degrees F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 degrees F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degrees F.

H. All Services

1. 2-1/2 inches and smaller: Screwed, Schedule 40 electro zinc plated ASTM A120/A53 casing with inert self-cleaning thermoplastic liner, 300 psi VP at 225 degrees F. Victaulic Clearflow Style 47 or equal (no known equal).
2. 3 inches and larger: Flanged with isolation gaskets, washers and sleeves, 300 lbs. WOG. Maloney or equal (no known equal).

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES AND OPENINGS

A. Provide sleeves for piping passing through walls, floors and roofs.

B. Set pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.

C. Locate chases, shafts and openings required for the installation of the mechanical work during framing of the structure. Do any additional cutting and boring required due to improperly located or omitted openings without cost to the Owner under the supervision of the Owner's Representative.

D. Size sleeves for below grade pipe a minimum of 2 inches beyond outside of pipe. Size above grade pipe sleeves in accordance with OSHPD State Fire Marshal requirements and UL Building Materials / Fire Resistive Directory.

E. Coat surface of all sleeves in contact with concrete, masonry or soil with two coats of coal tar bitumastic paint.

F. Provide sleeves as follows:

Location	Material
Interior Stud Partition Walls	Adjustable galvanized sheet metal with wall flanges and plaster lip. 2 inches and smaller - 22 gauge, 3 inches through 6 inches - 20 gauge, 8 inches and larger - 18 gauge.
Membrane Waterproof Floor, and Roof Construction	Galvanized cast iron body with flashing clamp, threaded for sleeve riser. (J.R. Smith 1760 or equivalent by Ancon, Zurn or Josam).
Nonmembrane Floor, Construction	Non-adjustable galvanized sheet metal with deck flange and end cap. 2 inches and smaller 22 gauge, 3 inches -20 gauge, 4 inches and larger - 16 gauge.
Floors of Mechanical Rooms, Concrete Walls or Masonry Walls above Grade	Standard weight galvanized steel pipe.

G. Length of sleeves as follows:

Location	Length
Floors	Equal to depth of floor construction including finish. Extend minimum of 1 inch above finished floor level within partitions, mechanical rooms, pipe chases and finished areas. Extend sleeves for non-metallic piping beyond floors or construction as required by the OSHPD State Fire Marshal.
Roofs	Equal to depth of roof construction including insulation. Extend sleeves for non-metallic piping below roof or construction as required by the OSHPD State Fire Marshal.
Walls	Equal to depth of construction. Extend sleeves for non-metallic piping beyond walls or construction as required by the OSHPD State Fire Marshal.

H. Firestopping: Provide OSHPD pre-approved firestopping assemblies at all pipe penetrations with construction and materials in conformance with the OSHPD State Fire Marshal requirements and the UL Building Materials / Fire Resistive Directory. Fill material to be 3M or equivalent by Dow Corning or Nelson Electric, as approved by Underwriters Laboratories, Inc.

I. Finish and Plates:

1. Smooth up rough edges around sleeve with plaster.
2. Provide 1 inch wide chrome or nickel plated plates on all pipes exposed to view, passing through floors, walls, partitions, plaster furring, etc. Escutcheons shall be sized to fit pipe and pipe covering and give a finished appearance. Escutcheons shall be held in place by setscrews.

J. Seal all penetrations through interior non-rated acoustic walls.

2.8 ESCUTCHEONS

A. All escutcheons shall be brass, polished chrome-plated.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Section 013000 – Cutting and Patching and Section 021419 Selective Structure Demolition for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Section 230500 – Basic Requirements for HVAC specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Pitch: All waste pipes shall be run at 2 percent slope unless specifically shown and approved otherwise by OSHPD per CPC 708.0.

D. Water Piping within Walls and Rough-ins for Fixtures and Equipment: Provide copper plated steel support system soldered to piping and secured to building construction so that pipes cannot be displaced. Provide trisolator or fire retardant closed cell elastomeric material between support system and building construction and other piping. Holdrite, Pipe Shields, Sioux Chief Manufacturing Co. or equal.

E. Waste and Vent Piping within Walls and Rough-ins for Fixtures and Equipment: Provide copper plated steel support system for copper DWV piping or galvanized steel support system for cast iron or galvanized piping, or cast iron soil pipes and fittings. Secure supports to piping and building construction so that pipes cannot be displaced. Provide felt strip isolation between dissimilar metals. Provide trisolator or fire retardant closed cell elastomeric material between support system and building construction and other piping. Holdrite, Pipe Shields, Sioux Chief Manufacturing Co., or equal.

F. Piping through walls serving fixtures, equipment and outlets. Provide temporary plastic sleeve installed around piping serving plumbing fixtures, equipment and outlets to provide clearance between the pipe and drywall or plaster construction at the point of pipe penetration. After the plumbing rough-in and drywall installation is completed, the plastic sleeve shall be removed and Type GR fire retardant sponge material installed to seal the pipe penetration. Specialty Products Acousto-Sleeve, 3M or equal.

G. Underground Piping: No-hub cast iron soil pipe are permitted.

H. Unions and Flanges: Provide on piping to inlet and outlet of all apparatus and equipment to facilitate removal of equipment, and downstream of all shutoff valves.

I. Flexible Connections: Install flexible pipe connectors at building seismic separations and between piping and motor driven equipment. Refer to Section 220516 – Expansion Fittings and Loops for Plumbing Piping.

J. Water Hammer Arresters: Install water hammer arresters at all quick closing valves such as flush valves, float valves, solenoid valves, etc. Size and locate all water hammer arresters as recommended by PDI Manual WH 201.

K. Water Piping:

1. Cut pipe square, ream full size, and remove all burrs. End of pipe must be thoroughly cleaned to one inch more than the depth of the fitting. Apply a coat of flux and make joint. Consult manufacturer's instructions for application of flux and joining technique. The use of tubing cutters is prohibited.
2. Iron Pipe Size (IPS) Brass Threaded Joints: Cut pipe square and ream full size. Cut threads with new, clean dies to standard tolerance. Make up with Teflon tape to male thread only. Remove exposed excess tape after joint is made.

L. Provide sleeves with fire rated insulation and resilient fire rated sealant at all pipe penetrations through walls and floors.

3.3 CLEANOUTS

A. Size: Cleanouts of same nominal size as pipe they serve except where they occur in piping 4 inches and larger, in which case they shall be 4 inches in size.

B. Accessibility: Make all cleanouts accessible, Use graphite on all cleanouts with all threads being thoroughly greased after acceptable pressure test.

C. Locations

1. At all horizontal offsets.
2. At ends of all lines more than 5 feet in length.
3. At 100 foot maximum intervals in all horizontal runs within the building lines, unless otherwise shown on the drawings.
4. At base of all stacks.
5. For cleanouts in finished portions of building, locations subject to the Owner's approval before installation.

3.4 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.5 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights, which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, hollow wall construction or above suspended ceilings.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties. Where possible, locate insulated piping for 1-inch clearance outside insulation.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

H. Do not route piping through or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

I. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where it requires the piping services indicated in this section.

3.6 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.7 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. Electrodes shall be Lincoln, or equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

3.8 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.9 PIPE WRAPPING FOR BURIED PIPING

A. Field made joints may wrap with 20 mil continuous PVC sleeves. Shall be applied only after the complete joint is heated to insure a complete bonding of the tape to the pipe. A finish coat of the approved bitumastic shall be applied.

3.10 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.11 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fittings ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

3.12 MECHANICAL JOINT PIPE CONNECTIONS

A. Clean pipe end and socket. Clean and lubricate pipe end and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

3.13 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 - Metal Fabrications for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

END OF SECTION 220500

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section includes valve specifications for all plumbing systems except where indicated under Related Sections. Included are the following topics:

1. Water System Valves:

    a. Ball Valves.
    b. Swing Check Valves.
    c. Balance Valves.
    d. Drain Valves.

2. Compressed Air Systems:

    a. Shut-off Valves.
    b. Safety Exhaust Shut-off Valves.
    c. Pressure Reducing Valves.

3. Specialty Valves and Valve Accessories:

    a. Gauge Valves.
    b. Water Pressure Reducing Valves.
    c. Safety Relief Valves.
    d. Sewer Air and Vacuum Valves.

1.2 SUBMITTALS

A. Refer to Section 230500 - Basic Requirements for HVAC.

B. Product Data: Submit catalogue cuts, specifications, installation instructions, and dimensioned drawings for each type of valve. Submit schedule of all valves indicating type of service, dimensions, and materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

1.3 DESIGN CRITERIA

A. Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

B. Provide all valves of first quality of approved manufacturer, have proper clearances, and be tight at the specified pressure. All pressure ratings are in psi steam working pressure, unless otherwise indicated.

C. All gate and globe valves suitable for repacking under pressure. Regardless of service, valves not acceptable when designed for less than 125 psi steam working pressure.

D. All valves must be the product of one manufacturer, except for special application.

E. Valves shall be line size unless specifically noted otherwise.

F. Valves shall be domestic made only.

G. All water supply valve shall comply with California AB 1953 no lead law.

PART 2 - PRODUCTS

2.1 WATER SYSTEM VALVES

A. All water system valves to be rated at not less than 125 steam working pressure at 240 degrees F unless noted otherwise. Water system valves through 4 inches to be rated for the following minimum Cv factors:

Size	3/4"	1 "	1-1/4"	1-1/2"	2"
Cv	18	35.5	61	107	175

B. Ball Valves:

1. 2-1/2 inches and smaller: Three piece bronze body; screwed or threaded ends, chrome plated stainless steel ball; Teflon seat; Teflon packing and threaded packing nut; blowout-proof stainless steel stem; 600 psig WOG.
2. Provide valve stem extensions if needed for valves installed in insulated pipe.
3. Nibco T-595-Y-66, 150 psi SWP, Milwaukee BA-300S or equal.

C. Gate Valve (Shut-Off Valve):

1. 2-1/2 inches and smaller: Nibco T-136, Milwaukee 1141 or equal threaded or soldered 300# WOG, bronze, non-rising stem, screw bonnet, solid wedge bronze disc.
2. 3 inches and larger: Nibco F-619, Milwaukee F-2882A or equal threaded or flanged end, 300# WOG, iron body bronze mounted, non-rising stem, bolted bonnet, solid bronze wedge disc.

D. Swing Check Valves:

1. 3 inches and smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, 200 psi WOG, suitable for installation in a horizontal or vertical line with flow upward. Nibco S413Y, Milwaukee 1509 or equal.
2. 4 inches and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, 200 psi WOG, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Nibco F918B, Milwaukee F-2794M or equal.

E. Spring Loaded Check Valves:

1. 2 inches and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 200 psi WOG, Teflon seat unless only bronze available. Nibco S480Y or equal.
2. 2-1/2 inches and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 200 psi WOG. Nibco W910 or F910, Milwaukee 1400 or equal.

F. Balance Valves: 2 inches and smaller: Bronze body globe or ball valve with calibrated brass orifice, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, sweat or threaded ends, with or without integral unions, pressure taps with integral check valves and seals, adjustable memory stop, suitable for 125 psig steam working pressure at 240 degrees F. Armstrong CBV, Bell & Gossett Circuit Setter Plus, or equal.

G. Strainer Drain Valves: Provide a blowdown valve with a drain line to discharge above an approved receptor on the blowdown of the strainer. Where strainers occur above ceilings, provide a blowdown valve with a 3/4 inch capped hose adapter fitting.

2.2 SPECIALTY VALVES AND VALVE ACCESSORIES

A. Gauge Valves: Use 1/4 inch ball valves. Needle valves and gauge cocks shall not be accepted.

PART 3 - EXECUTION

3.1 GENERAL

A. Properly align piping before installation of valves. Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

B. Mount valves in locations, which allow access for operation, servicing and replacement. Valves shall be visible and accessible above ceilings.

C. Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Non-rising stem valves may be installed with the stems down.

D. Prior to flushing of piping systems, place all valves in the full-open position.

E. Extend all valve handles on insulated piping systems to prevent damage to pipe insulation.

3.2 SHUT-OFF VALVES

A. Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

3.3 BALANCING VALVES

A. Install where indicated on the drawings and details for balancing of pumped systems. Retain the shipping container for use as removable insulation.

3.4 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

3.5 SPRING LOADED CHECK VALVES

A. Install a spring loaded check valve in each circulating pumps discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

3.6 SWING CHECK VALVES

A. Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

END OF SECTION 220523

SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 References:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Codes, standards and specifications applicable to this work shall be latest editions and applicable addendum in effect at date of proposal.

1. ASME B31.1 - Code for Power Piping.
2. ASME B31.9 – Building Services Piping.
3. ASTM E119 – Methods for Fire Tests of Building Construction and Materials.
4. ASTM E814 – Test Method of Fire Tests of Through Penetration Firestops.
5. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
6. AWS D1.1 – Structural Welding Code.
7. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
8. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
9. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
10. SMACNA – Seismic Restraint Manual.

1.3 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.
7. Flashing.
8. Sleeves.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 as applicable.

B. Shop Drawings: Indicate system layout with dimensioned location and detail of pipe hangers including trapeze hanger installations.

C. Product Data: Provide manufacturers catalog data including load capacity. Provide piping and equipment supports, hangers, guides and anchors as indicated on the drawings and as specified herein.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Submit a schedule showing each pipe support by identification no. with a cross reference to the support location on plan and to attached product data. Combine with shop drawings specified in Section 230500.

F. Submit details and supporting calculations for all pipe supports, anchors, guides, and their attachments. Calculations shall be performed, stamped and signed by a California registered structural engineer and shall be approved by OSHPD prior to installation. The submittal shall include load capacity sheets for all pipe support points and all seismic pipe support locations. No loads shall exceed the limitations provided on the Drawings and in the Specifications. Load calculations shall include forces due to expansion of pipework.

G. Installation instructions.

H. Provide material identification certificates for all base metals.

I. Operation and Maintenance Data:

1. Submit operation and maintenance data under provisions of Division 01 as applicable.
2. Include assembly views, lubrication instructions, and replacement parts list.
3. Submit for pipe supports, hangers, guides and anchors.

1.5 QUALITY ASSURANCE

A. All suspended piping, ductwork, condensate drip pans and trays, conduit and cable trays shall be provided with seismic sway braces with one of the OSHPD pre-approved systems: 1. OSHPD OPM-004-13 Mason Industries, Inc. Seismic restraint components for suspended utilities. 2. OSHPD OPM-0052-13 B-Line/Tolco Seismic bracing and support systems. Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Steel aircraft cables shall be prestretched to establish a certified minimum modulus of elasticity. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system. Steel angles, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. The bracing system shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying its capability to resist seismic forces.

B. Where preapproved details do not fit, a custom brace shall be designed, engineered and built by the system contractor. These details shall be reviewed, stamped and approved by a State of California registered Professional Structural Engineer before installation.

C. Use proprietary systems in consultation with Owner and Project Structural Engineer if SMACNA does not cover the specific project applications. When manufacturer specific bracing systems are used, select industry standard components for strut, strut clamps, strut fittings, strut nuts, hangers, pipe clamps etc.

D. Do not mix seismic bracing designs within a given new system design.

E. Fire protection piping shall be seismically braced, supported and attached to the structure according to NFPA 13 and Section 210000 Common Work Results for Fire Protection. Final connections to the building structure shall comply with CBC requirements.

F. All conditions which involve thermal and/or building expansion and contraction shall be taken in consideration and identified in the as-built documents.

G. Seismic bracing, support and anchorage to the structure of all conditions that involve thermal and/or building expansion and contraction shall be engineered and built by the applicable system contractor. When applicable SMACNA pre-approved OSHPD seismic bracing, support and anchorage details shall be used. The Contractor shall address all locations, whether shown or not, in accordance with current construction standards listed in the Specifications. These engineered assemblies shall be submitted as shop drawings with engineered calculations fore review and approval. In addition, the loading requirements shall not exceed the maximum requirements indicated on the Drawings and in the Specifications. Review these details with project structural engineer and mechanical engineer.

H. Contractor shall submit, prior to installation, seismic brace detail(s), seismic brace connection to system detail(s), seismic brace connection to structure detail(s) and seismic brace spacing or layout details, all certified by a State of California registered Professional Structural Engineer.

I. All data submitted as being pre-approved by OSHPD shall be invalid and unusable, unless each individual page is marked with an active, non-expired, dated and signed OSHPD stamp.

J. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase. Do not size connection to the structure according to threaded hanger rod size. Loading of the building structure shall not exceed the limitations provided in the Specifications and on the Drawings.

K. Conractor shall submit, prior to installation, data identifying the various supports to structure connections and seismic brace structure connections. Submittal data shall identify the following:

1. Location of connections.
2. Numerical identification of maximum allowable design value of connecting method.
3. Numerical value of applied load or reaction.
4. Type of connection (vertical support, vertical support with seismic brace, seismic brace).
5. Seismic brace reaction type (tension only, tension and compression).
6. Detailed drawing (listing all related components) of method of connections.

L. Applications listed within SMACNA preapproval that are not usable within a given structure, shall be resolved through engineered adaptations or alteration. Whenever possible these adaptations or alterations shall use SMACNA approved components, so as to maintain compliance and uniformity with SMACNA engineering standards and design principles. In all cases, and prior to installation, these adaptations or alterations shall be engineered in accordance with standard engineering practices by a State of California registered Professional Structural Engineer, and shall be submitted to project structural engineer and mechanical engineer for their review and approval.

M. All base material shall be electrogalvanized. Products other than final finishes shall not be accepted.

N. All pipe supports shall be painted with a zinc based paint where the original plating has been removed due to welding, threading or scraping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe Shields Inc.

B. Rilco Manufacturing.

C. Tolco.

2.2 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the ICC ES or OSHPD standards.

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following:

1. ICC ES evaluation report
2. OSHPD pre-approved

C. Lab test report verifying compliance with OSHPD IR 26-6, Paragraph 1.

D. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips.

E. All over-head concrete anchors or inserts shall be selected from listings within the manufacturer preapproval and shall have maximum allowable design tension or shear values no greater than those listed within the manufacturer preapproval manual.

F. All anchors, inserts or connections to the structure shall be submitted to the structural engineer of record for approval. Submittal review and/or acceptance by the mechanical or electrical engineer of record shall not constitute compliance or usability.

G. Approved Insulated Pipe Supports:

1. Pipe supported on rod hangers - use Models A1000, A2000, A3000, A4000 and A9000.
2. Pipe supported on flat surfaces - use Models A1000, A2000, A5000, A6000, A7000, A7200 and A7400 Series.
3. Pipe supported on pipe rolls - use Models A3000, A4000, A5000, A6000, A8000, A8200 and A8400 Series.
4. Model designations are by Pipe Shields, Inc. Use only models designed for service for which supports are to be used
5. Pre-insulated pipe support will need to be provided for all insulated hot and cold water piping for both horizontal and vertical installation.

H. Plumbing Piping – Drain, Waste and Vent:

1. Conform to ASME B31.1, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron or Carbon steel, adjustable swivel, split ring. Provide double nuts on rods.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Provide double nuts on rods.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Provide double nuts on rods. Pipes shall be secured with U-bolts or pipe clamps to trapeze.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Pre-insulated Steel riser clamp. For copper piping install sheet lead packing between riser clamp and piping.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated. Provide Trisolators or felt-lined hangers to minimize vibration transmission and for all copper pipes in contact with ferrous supports or adjacent surfaces.

I. Plumbing Piping – Domestic and Industrial Water:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron or Carbon steel, adjustable swivel, split ring. Provide double nuts on rods.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Provide double nuts on rods.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis. Provide double nuts on rods.
5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger. Provide double nuts on rods.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Provide double nuts on rods. Pipes shall be secured with U-bolts or pipe clamps to trapeze.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll. Provide double nuts on rods. Pipes shall be secured with U-bolts or pipe clamps to trapeze.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: pre-insulated steel riser clamp. For copper piping install sheet lead packing between riser clamp and piping.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Insulated Pipe Supports For Domestic Hot Water: Pipe supports for piping shall be Pipe Shields, Inc. A-Series, Tolco, or equal, supports selected by hanger type and support spacing. On domestic hot water up to 2-inches, size the use of shields and saddles are not required.
16. Copper Pipe Support: Carbon steel ring, adjustable, copper plated. Provide trisolators or felt-lined hangers to minimize vibration and noise transmission from water hammer and for all copper pipes in contact with ferrous supports or adjacent surfaces.

J. Box type inserts which allow movements for horizontal adjustment shall not be allowed, unless engineered solution is provided to assure positive captive positioning and securement of load bearing attachment.

K. All combined tension and sheer anchor or insert attachments shall be engineered.

L. All unusable and/or non-compliance anchors or inserts, shall be cut-off flush with the concrete or removed at the contractors expense.

M. Job site torque and/or load or pull testing shall not be allowed as justification for use of non-compliance anchors or inserts.

N. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

O. 50 percent of anchors installed in concrete shall be tested in alternate groups, upon failure of an anchor, the next 20 consecutive anchors must pass, before 50 percent alternate group testing can resume.

P. If anchor failures are due to contractor error, retesting of failed anchors as well as consecutive anchor testing to confirm contractor's ability to properly install anchors will be at the contractor's expense.

Q. All items attached to or support from structural or immediate steel, shall have a positive assembly and shall be through bolted, welded or clamped to the steel. All clamps shall be constructed of malleable iron or steel and shall include a retaining strap or J-hook.

R. Provide pre-insulated anchors at insulated pipework sections.

2.3 PIPE ISOLATORS

A. Provide each hanger or clamp for uninsulated piping with a metal-backed pipe isolating material to isolate sound vibration and electrolysis.

2.4 HANGER RODS

A. Provide steel hanger rods, continuously threaded with turn buckle. Provide connection points with jamb nuts or double nuts. Rod sizes shall comply with CPC's min Rod size requirement.

2.5 SLEEVES

A. Sleeves for Pipes Passing through Nonrated, Nonbearing Walls and Floors: 20 gauge, galvanized sheet metal tube with welded longitudinal joints.

B. Sleeves for Pipes Passing through Walls and Footings: Schedule 40 black steel pipe.

C. For waterproof sleeves, Manufacturer:

1. Thunderline Link-Seal, Inc. Model C

a. Product Description:

1) Modular Seal Rubber Links: Mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
2) Pressure Plates: Modular seal pressure plates shall be molded of glass reinforced nylon. For fire and high temperature service pressure plates shall be steel with zinc dichromate coating.
3) Include wall sleeve for all mechanical sleeve seals. High density polyethylene Model CS Century-Line sleeves by Thunderline Link-Seal.

D. All pipes except sprinkler piping passing through fire-rated walls and floors shall be UL listed fire-rated assemblies. Refer to Division 07 for fire-rated sealants. Pipe insulation carried through the penetration shall comply with the UL system requirement, but shall not be less than required in Section 220700 - Piping Insulation and Section 230716 - Equipment Insulation. All sprinkler piping passing through fire-rated walls or floors shall be provided with pipe sleeves having a clearance of nominal 2 inches larger diameter than the nominal pipe diameter up to 3-1/2 inches. For sprinkler piping 4 inches and larger provide a pipe sleeve of nominal 4 inches diameter larger than the nominal pipe size. Coordination shall be required between the fire sprinkler and drywall contractors for proper installation / location of stud assemblies at piping penetrations.

E. Open voids and cavities occurring in pipe sleeves passing through rated walls and floors shall be completely sealed with UL classified Dow Corning Fire Stop Sealant No. 2000 installed in strict accordance with the manufacturer's recommendations.

F. Size sleeves large enough to allow for movement due to expansion and to provide for continuous insulation.

G. The drywall contractor and the MEP contractors shall provide a field sample / mock-up of each penetration condition. These shall be reviewed and approved by the design team and the Owner's Representative. Prior to conducting this mock-up, all trades shall provide a fire safing submittal specific to this project clearly noting the assemblies / details that shall be used on this project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to the Drawings for limitations on supporting from the building structure and for the location of all structural steel pipe supports.

B. Install in accordance with manufacturer's instructions.

3.2 INSERTS

A. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches

B. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Where inserts are omitted, provide drill-in expansion anchors. Expansion anchors to be used for minor work only. Cutting of rebar will not be permitted.

D. Shot pin fasteners shall not be used.

E. Expansion anchors shall only be used for relocations and for incidental use.

3.3 PIPE HANGERS AND SUPPORTS INSTALLATION

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping. Use pre-insulated riser supports for all insulated pipework.

I. Provide copper plated hangers and supports for copper piping; sheet lead packing between hanger and support and piping.

J. Provide hangers for pipe movement without disengagement of supported pipe.

K. Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.

L. Support piping immediately adjacent to hydronic coil connections.

M. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69, and MSS SP-89.

N. All insulated supports and anchors shall be installed according to manufacturer's installation instructions. All insulated supports and anchors shall be from the same manufacturer.

3.4 SCHEDULES

A. Piping Support Schedule - Horizontal

Type of Pipe	**1/2" to 3/4"**	**3/4" to 1"**	**1-1/4"-2"**	**2-1/2" & Over**
Copper Pipe	6'-0"	6'-0"	8'-0"	10'-0"

B. Cast Iron: Support at every joint, each side of no-hub coupling, and 10 feet -0 inches maximum

C. Piping Support Schedule - Vertical

Type of Pipe	**1/2" to 3/4"**	**3/4"to 1"**	1-1/4"-2"	**2-1/2" & Over**
Copper Pipe	6'-0"	6'-0"	8'-0"	12'-0"

D. In addition, support pipes at the base of each riser.

E. Cast Iron: Support at every joint, each side of no-hub coupling, and 10 feet -0 inches maximum.

Pipe Size	**Rod Size**	**Maximum Design Load**
2" and smaller	3/8"	610 #
2-1/2" to 5"	1/2"	1130 #

NOTE: All spacing shall meet OSHPD California Plumbing Code, 2013, Table 3.2 requirements and codes.

3.5 PRIMING

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipes shafts and suspended ceiling spaces are not considered exposed.

3.6 SLEEVES

A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

B. Where piping passes through floor, ceiling or non fire-rated wall, close off space between pipe and construction with noncombustible insulation. Provide tight-fitting metal caps on both sides and caulk.

C. Install chrome-plated escutcheons where piping passes through finished surfaces.

D. Provide pipe sleeves for all piping.

E. Adequately sleeve pipe passing through concrete or masonry walls or concrete slabs to receive both pipe and insulation pertaining thereto.

F. Waterproof sleeves shall be provided at all below grade wall penetrations.

G. Seal pipes passing through walls or slabs. Use mastic or oakum seal in the annular space in nonfire-rated walls.

H. Insulated pipe shall be insulated in sleeves, sealed, and pointed as above.

I. Install sleeves on pipes as they are being hung, ready for proper placement in wall as wall is being constructed.

J. Where sleeves have been inadvertently omitted in concrete floors, provide requisite pipe opening by using properly sized diamond core drills after coordination with Structural Engineer. Areas located below drilling operations shall be protected from possible damage.

END OF SECTION 220529

SECTION 220548 – SEISMIC CONTROLS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the Work of this Section.

1.2 DESCRIPTION

A. Engineering for all bracing, anchorage and seismic restraints.

B. Seismic restraints for all piping and in-line devices.

C. The contractor is responsible for selecting, engineering, and incorporating all bracing, anchorage and seismic restraints.

1.3 QUALITY ASSURANCE

A. Design Criteria:

1. Anchorage and Bracing: Anchor, support and brace all piping and ductwork to resist seismic forces in accordance with requirements for anchorage bracing as specified.

B. Testing Laboratory:

1. Testing Laboratory will test expansion bolts as specified in Section 055000.

C. Requirements of Regulatory Agencies:

1. CCR - California Code of Regulations, Title 24, Building Standards.

   a. Part 6, Special Building Regulations 2013.
   b. Chapter 23, Table 23-P.

2. NFPA - National Fire Protection Association.

   a. Pamphlet 13 2013, Standards for Installer of Sprinkler Systems.

D. Reference Standards:

1. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

    a. "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems," OSHPD pre-approved No. R-0100.

2. Codes and Standards for Noise Control:

    a. ASTM E90 - American Society of Testing and Materials: Method for Measuring Sound Transmission Loss.
    b. ASTM E413 - American Society of Testing and Materials: Determination of Sound Transmission Class
    c. SMACNA Sheet Metal and Air Conditioning Contractors National Association

1.4 DESIGN RESPONSIBILITY

A. Design support and anchorage systems in accordance with procedures indicated herein and in Section 014000.

1.5 SUBMITTALS

A. Product data and current OSHPD Certification Number verifying that the system is currently pre-approved by OSHPD, or provide calculations to demonstrate compliance with the requirements of regulatory agencies.

B. Submit anchorage and bracing calculations stamped and signed by a California-registered Structural Engineer for all equipment as required by State, Federal or regulatory agencies. Calculations shall clearly show equipment weight, equipment center of gravity, location of attachment to the structure, and the seismic and gravity forces at each attachment location. Include designs for the attachment of the equipment or equipment support base to the structure, and the equipment to the support base.

C. Note compliance with seismic regulations on submittals.

D. Submit record drawings reflecting actual conditions.

E. Submit spacing and details of support and bracing of fire sprinkler piping. Provide anchorage details and calculations for the connection of sway bracing to the structure. Design loads for the anchorage shall be computed per OSHPD OPM-004-13 Mason Industries, Inc. Seismic restraint components for suspended utilities. Where applicable, details for the support and bracing may be referred to OSHPD pre-approved anchorage system such as OSHPD OPM-0052-13 B-Line/Tolco Seismic bracing and support systems, etc. All shop drawings for the sprinkler system shall be submitted to OSHPD for review and approval prior to submittal to Architect and installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:

1. Supports:

a. Superstrut.
b. SMACNA Guidelines.
c. Tolco.
d. Or equal.

B. Pipe and Duct Seismic Supports:

1. Provide products with current OSHPD certification number or provide calculations demonstrating compliance with regulatory requirements. Only known complying systems are SMACNA "Guidelines for Seismic Restraint System," OSHPD OPM-004-13 Mason Industries, Inc. Seismic restraint components for suspended utilities, OSHPD OPM-0052-13 B-Line/Tolco Seismic bracing and support systems.
2. Provide seismic bracing of mechanical, electrical and plumbing ductwork, conduits, and piping in accordance with the requirements of ASCE 7 Section 13.6 as modified by the CBC 2013 Section 1616A.

C. Concrete Anchors: OSHPD approved anchors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Suspend supporting piping from structural members.
2. Provide a minimum of 1 inch clearance between the building structure and pipes, and equipment.
3. Do not use vibration isolation components to straighten or connect misaligned sections of piping.

B. Piping:

1. Support and brace all piping as required in ASCE 7 Section 13.6 as modified by the CBC 2013 Section 1616A.
2. Use trapezes for vertical support to horizontal piping only. Brace trapeze with an OSHPD pre-approved bracing system, or provide calculations demonstrating compliance with regulatory requirements.

3. Fire Protection Piping: Support and brace in accordance with NFPA Pamphlet 13 2013. Piping 2-1/2 inches and larger and 12 inches or more below the attachment to the building structure shall be supported in accordance with NFPA 13 but shall be seismically braced.
4. No electrical conduit, fixture, ceiling suspension wires or other elements of the building construction attached to or abutted against piping systems.
5. Where piping penetrate sound-isolation partitions, caulk the penetration airtight with Tremco Mfg. Co. acoustical sealant or equal. For indoors, provide non-toxic sealant approved for indoor use.
6. Contain rough-in of piping within stud wall cavities no less than 1/4-inch from the plane of the studs and 1 inch from gypsum board or other wall sheathing.
7. Do not suspend plumbing or piping from ducts, conduits or related supports.

END OF SECTION 220548

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:

1. General
2. Materials
3. Insulation & Jackets
4. Accessories

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections include the following:

1. Division 21 Section - Fire-Suppression Systems Insulation.
2. Division 23 Section - HVAC Insulation.

1.2 REFERENCES

A. Standards referenced in this section are as follows:

1. ASTM/ANSI C195: Mineral Fiber Thermal Insulation Cement.
2. ASTM/ANSI C533: Calcium Silicate Block and Pipe Thermal Insulation.
3. ASTM/ANSI C547: Mineral Fiber Preformed Pipe Insulation.
4. ASTM/ANSI C552: Cellular Glass Block and Pipe Thermal Insulation.
5. ASTM/ANSI C553: Mineral Fiber Blanket and Felt Insulation.
6. ASTM/ANSI C612: Mineral Fiber Block and Board Thermal Insulation.
7. ASTM B209: Aluminum and Aluminum Alloy Sheet and Plate.
8. ASTM C449: Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

1.3 QUALITY ASSURANCE

A. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

C. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

1. Pipe Insulation.
2. Insulation for exposed waste piping from handicapped fixtures.

B. Install all insulation in accordance with manufacturer's installation instructions.

1.5 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports..

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 220529 - Hangers and Supports for Plumbing Piping and.

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For materials refer to Section 230719 - HVAC Piping Insulation.

B. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less.

C. Comply with requirements in PART 3 schedule articles for where insulating materials shall be applied.

D. Products shall not contain asbestos, lead, mercury, or mercury compounds.

E. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

F. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

G. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

E. Finishing cement to be ASTM C449.

F. Fibrous glass cloth shall have a minimum untreated weight of 6-oz/sq. yd.

G. Bedding compounds to be non-shrinking and permanently flexible.

2.3 PIPE AND FITTINGS

A. Domestic Cold water, Hot Water Supply and Return Insulation Thickness - Refer to table 6.8.3-1 Min. Piping insulation thickness of ASHRAE 90.1 2013 edition.

B. Provide insulation for all condensate tubes.

C. Provide insulation for storm or sanitary piping located in the ceiling directly below roofs.

D. Material: One-piece molded glass fiber, with a maximum K factor of 0.22 at 75 degrees F mean temperature with factory applied fire retardant jacket with 4 inch wide longitudinal lap. Service up to 850 degrees F. Schuller International, Inc. "Micro-Lok."

E. Application

1. Longitudinal lap and 4 inch wide joint sealed strips neatly in place with fire retardant adhesive. Use no staples.
2. Tightly butt all joints together and cover with 2 inch wide fire retardant jacket strip and fire retardant adhesive. Use no staples.
3. Seal off ends of pipe insulation with fire retardant adhesive.
4. Insulate fittings, valves, and flanges with the same material and of the same thickness as the adjoining pipe. Factory premolded one-piece polyvinyl chloride (PVC) fitting covers shall be installed in accordance with the fitting cover manufacturer's recommendations. Apply vapor barrier mastic around the edges of the adjoining pipe insulation and along the inside of the fitting cover throat overlap seam. Place the fitting cover over the insulation, lapping the mastic covered edge over the other side of the throat seam. Apply pressure sensitive tape over the circumferential joints. Factory precut blanket inserts provided by the fitting cover manufacturer may be used: Insert shall be installed in accordance with the fitting cover manufacturer's recommendations.

5. Apply a layer of white 8-1/2 oz., 25/50 fire retardant fiberglass cloth lagging fabric on all pipe insulation exposed within the building. Adhere laps with white 25/50 fire retardant adhesive and cover the entire outer surface with brush coat of the adhesive (Alpha and Foster 3036).
6. Direct contact with pipe and hanger shall not be acceptable. Install hanger outside of sheet metal protection shield covering an insert section of high-density insulation. Apply the vapor barrier continuous behind the saddle or lap over the saddle and securely cemented.

2.4 HANDICAPPED LAVATORIES OR SINKS

A. Hot water supply riser, tailpiece, and trap arm to be insulated with ½" thick Armstrong "AP Armaflex" pipe insulation with Manville "Zeston PVC/Perma-Weld" jacket.

B. Trap and supply stop shall be insulated with PVC insulated fitting covers, such as Trubro Lav Guards, ADA insulated covers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Insulation, jacket, and covers shall be installed in accordance with manufacturer's standard specifications for the product application, except where required to be exceeded as specified herein. Surfaces to be insulated must be clean and dry. Insulation, jackets, or accessories shall only be installed under ambient temperatures or conditions recommended by the manufacturer of the material.

B. For exposed pipe, all seams shall be at the top of pipe or on the side opposite normal field of view. For metal jacketed pipe, seams shall be at the bottom of pipe.

C. Do not insulate systems or equipment, which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

D. Insulation and jackets shall be provided as indicated in schedules. Schedules apply to both exposed and concealed applications unless noted otherwise.

E. Install insulation with smooth and even surfaces, and on clean and dry surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

F. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation will not be accepted. Pieces cut undersize and stretched to fit will not be accepted.

G. Install jackets with longitudinal joints facing wall or ceiling.

H. Insulation shall be continuous through sleeves and openings except where fire rated penetration materials require interruption of insulation. Vapor barriers shall be maintained continuous through all penetrations.

3.3 PENETRATIONS

A. Insulation installation at roof penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation installation at underground exterior wall penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation installation at aboveground exterior wall penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation installation at interior wall and partition penetrations (that are not fire rated): Install insulation continuously through walls and partitions.

E. Insulation installation at fire-rated wall and partition penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section - Penetration Firestopping for firestopping and fire-resistive joint sealers.

F. Insulation installation at floor penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section - Penetration Firestopping.

3.4 PIPING, VALVE AND FITTING INSULATION

A. Fittings and valves may be insulated with factory molded, or built up insulation. Built up insulation must have the same thickness as adjoining insulation.

B. One piece insulated PVC covers may be used for fittings and valves if insulation thickness and thermal performance is the same as adjoining insulation. Seams and joints between PVC cover and adjoining pipe insulation must be covered with 2 inch wide, 10-mil PVC tape and one coat of vapor barrier mastic.

C. Provide inserts of heavy density block insulation and galvanized sheet metal shields at hanger or support locations. Block insulation to be preformed for the pipe size and cover the bottom 180 degrees of the pipe. Insert must be full thickness of adjacent pipe insulation, installed under the finish jacket on piping 1-1/2 inches and larger to prevent insulation from sagging or compressing at support points. Inserts shall be heavy density insulating material, minimum 30-psi compressive strength, suitable for the operating temperature range of the system being insulated. Wood blocks and block insulation cut into strips will not be accepted. Sheet metal shields must be installed on all insulated piping at hanger or support locations. Insulation inserts and galvanized sheet metal shields shall not be less than the following lengths and gauges:

Pipe Size	**Length**	**Gauge**
Through 2-1/2 inches	12 inches	22
3 inches to 6 inches	12 inches	20
8 inches to 10 inches	18 inches	16
12 inches and larger	24 inches	14

D. Insulation shall be applied to piping with butt joints and longitudinal seams closed tightly.

E. Minimum acceptable lap on factory-applied jackets shall be 2 inches, firmly cemented with lap adhesive.

F. All joints shall be covered with factory furnished tape (2 inches minimum width) to match the jacket, firmly cemented with lap adhesive.

G. Install insulation with smooth and even surfaces, and on clean and dry surfaces. Provide neatly beveled terminations. Poorly fitted terminations or use of filler in voids will not be accepted.

H. Where metal jackets are used for exterior applications, locate seams on bottom side of horizontal piping.

I. Insulation to be continuous through pipe hangers and supports, with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing / coating around riser clamp.

J. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers and specialties. Finish with glass cloth and vapor barrier mastic.

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

K. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

END OF SECTION 220700

SECTION 221116 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes domestic water piping and water meters inside the building.

B. Water meters will be furnished and installed by utility company.

C. Related Sections include the following:

1. Section 220519 - Meters and Gauges for Plumbing Piping for thermometers, pressure gauges, and fittings.
2. Section 221119 - Domestic Water Piping Specialties for water distribution piping specialties.
3. Section 220500 - Common Work Results for Plumbing.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 REFERENCES

A. ASTM B32: Solder Metal.

B. ASTM B88: Seamless Copper Water Tube.

C. ASTM B813: Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.

D. AWWA C651: Disinfecting Water Mains.

E. California AB 1953 'no lead' Bill.

1.5 SUBMITTALS

A. Refer to Section 230500 - Basic HVAC Requirements.

B. Product Data: For pipe, tube, fittings, and couplings and water meters.

C. Water Samples: Specified in PART 3 - Cleaning Article.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, Drinking Water System Components - Health Effects; Sections 1 through 9, for potable domestic water piping and components.

C. Manufacturers: Firms regularly engaged in manufacture of pipe, tube and fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to PART 3 - Pipe and Fitting Applications Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 DOMESTIC, INDUSTRIAL WATER PIPING

A. Piping:

1. Underground: ASTM B-88 Type K seamless copper piping, hard temper, cold drawn coated and wrapped with extruded high density polyethylene tape. AWWA C105. Provide clean sand backfill to a depth of 6 inches in all directions.
2. Above Ground: ASTM B-88 Type L seamless copper tubing, hard temper, cold drawn.

B. Fittings:

1. Copper piping: ANSI B16.22 wrought copper solder sweat type.
2. Brass: ANSI B16.15 85 percent red brass, cast iron pattern. Screwed type may be used where close fitting is required.
3. Adapters: Use where copper piping connects to iron pipe size brass piping.
4. All joints shall be made with approved fittings. Mechanical formed tee fittings utilizing mechanically extracted collars shall not be used.

C. Joining for Copper Pipes: For above ground piping 3 inches or smaller, Silvabrite, Bridgit, Stay-Safe 50 or equal lead free solder. For above ground piping 4 inches and larger, lead-free Silfos. For underground piping, brazing shall be required.

D. Unions and Flanges: ANSI B16.18 cast bronze, ground joint unions for sizes 2-1/2 inches and smaller. ANSI B16.24 Class 150 cast bronze flanges for copper tubing sizes larger than 2-1/2 inches.

2.3 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Section 220523 - General-Duty Valves for Plumbing Piping.

B. Balancing and drain valves are specified in Section 221119 - Domestic Water Piping Specialties.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 31 Section - Earth Moving.

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Aboveground Domestic Water Piping:

1. All Sizes: Hard copper tube, Type L; soldered joints.

D. Belowground Domestic Water Piping:

1. All Sizes: Hard drawn copper tube, Type K; soldered joints.
2. Type L hard drawn copper tube may be used for belowground trap primer piping.

E. Non-Potable-Water Piping:

1. All sizes: Hard copper tube, Type L; soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2and smaller.
2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
3. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2and smaller. Use gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2and larger. Balancing valves are specified in Section 221119 - Domestic Water Piping Specialties.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Section 220500 - Common Work Results for Plumbing.

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Pressure gauges are specified in Section 220519 - Meters and Gauges for Plumbing Piping, and drain valves and strainers are specified in Section 221119 - Domestic Water Piping Specialties.

D. Install domestic water piping level without pitch and plumb.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Section 220500 - Common Work Results for Plumbing.

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Pipe hanger and support devices are specified in Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials. See Division 23 Section - Common Work Results for Plumbing.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section 224000 - Plumbing Fixtures.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

7. Make pressure test in presence of Owner.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppmof chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppmof chlorine. Isolate and allow to stand for three hours.
        3) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
        4) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. ANSI A112.26.1/PDI WH-201: Water Hammer Arresters.

B. ASSE 1001: Pipe Applied Atmospheric Type Vacuum Breakers.

C. ASSE 1010: Water Hammer Arrestors.

D. ASSE 1011: Hose Connection Vacuum Breakers.

E. ASSE 1012: Backflow Preventers with Intermediate Atmospheric Vent.

F. ASSE 1013: Reduced Pressure Principle Backflow Preventers.

G. ASSE 1018: Trap Seal Primer Valves.

1.3 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers
2. Backflow preventers
3. Water pressure-reducing valves
4. Balancing valves
5. Temperature-actuated water mixing valves
6. Strainers
7. Outlet boxes
8. Hose bibbs
9. Relief valves
10. Drain valves
11. Water hammer arresters
12. Air vents
13. Trap-seal primer valves

B. Related Sections include the following:

1. Section 220519 - Meters and Gauges for Plumbing Piping for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 224000 - Plumbing Fixtures.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

B. Provide valves with screwed or flanged ends as required by piping system in which they are installed and as specified. All valves shall have the name of the manufacturer and working pressure cast or stamped on.

1.5 SUBMITTALS

A. Refer to Section 230500 - Basic HVAC Requirements.

B. Product Data: Submit manufacturer's technical product data including rated capacities of selected model clearly indicated, furnished specialties, and accessories, and installation instructions.

C. Submit data concerning sizes, utility sizes, rough-in dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, required clearances, and appropriate identification.

D. Plumbing products requiring approval by the State of California must be approved or have pending approval at the time of shop drawing submission.

E. Operation and Maintenance (O&M) Data: Submit in accordance with Section 017820 all maintenance data and parts lists for each type of plumbing fixture and accessory including troubleshooting maintenance guide.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance: Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

C. California AB 1953 'no lead' Bill.

D. Design Concept: The Drawings indicate capacities, sizes, and dimensional requirements of system components. Components having equal performance characteristics that deviate from the indicated size and dimensions may be considered provided deviations do not change the design concept or intended performance. The burden of proof for equality of products is on the Contractor.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. FEBCO; SPX Valves & Controls, Series 710 or 715.
   b. Watts Industries, Inc.; Water Products Division, Series 288A.
   c. Zurn Plumbing Products Group; Wilkins Division, Series 35.

2. Standard: ASSE 1001, IAPHO listed.
3. Size: NPS 1/4 to NPS 3 to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Watts Industries, Inc.; Water Products Division, Series 8.
   b. FEBCO; SPX Valves & Controls, Series 731.
   c. Zurn Plumbing Products Group; Wilkins Division, Series BFP-8F.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. FEBCO; SPX Valves & Controls Series 765 or 765U.
   b. Watts Industries, Inc.; Water Products Division, Series 800 M4QT.
   c. Zurn Plumbing Products Group; Wilkins Division, Series 720A.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:

   a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers (RPBP):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. FEBCO; SPX Valves & Controls, Series 860 or 825XD.
    b. Watts Industries, Inc.; Water Products Division, Series 909.
    c. Zurn Plumbing Products Group; Wilkins Division, Series 975.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure application.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for [horizontal, straight through] [vertical inlet, horizontal center section, and vertical outlet] [vertical] flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Beverage Dispensing/Ice Making Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Watts Industries, Inc.; Water Products Division, Series 9BD.
    b. Zurn Plumbing Products Group; Wilkins Division, Series 740.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded, or soldered.

2.3 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ITT Industries; Bell & Gossett Division, Series A-508 Circuit Setter.
    b. Griswold Controls, Series Isolator "Y".

c. Watts Industries, Inc.; Water Products Div.

2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2.

2.4 TEMPERATURE ACTIVATED WATER MIXING VALVES

A. Thermostatic Mixing Valve (TMV-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chicago Faucet.
b. Zurn Plumbing Products Group; Wilkins Div.
c. Simmons.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers:

a. Conbraco, Series 59-300L.
b. Wilkins, Series YB.

2. Pressure Rating: 125 psig minimum, unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations, unless otherwise indicated.
6. Perforation Size:

a. Recommended size by equipment or valve manufacturer.

7. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers:

a. Woodford, Series B24.
b. Acorn, Series 8126 and 8121.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.

6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral**,** nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze.
10. Finish for Service Areas: Rough bronze.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.
17. HB-1: Recessed. Brass hose bibb box with door, cast brass finish, loose key stop and vacuum breaker. Woodford #B24.
18. HB-2: Pipe mounted. Acorn # 8126 rough bronze with vacuum breaker.
19. HB-3: Recessed Wall mounted. Acorn # 8121 with vacuum breaker, polished chrome plated.

2.7 STOP AND DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Conbraco, Series Apollo 95-200-27.
2. Standard: MSS SP-110 for standard-port, two-piece ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 3/4.
5. Body: Bronze.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. Handle: Vinyl-covered steel.
9. Inlet: Threaded or solder joint.
10. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
11. Designed for soft solder and brazing installation.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. PPP Inc.
    b. Watts, Series 15.
    c. Zurn Plumbing Products Group; Wilkins, Series 1250.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves (TP):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. PPP Inc.
   b. Sioux Chief Manufacturing Company, Inc.
   c. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze body, O-ring seals, integral threaded outlet vacuum breaker, in conformance with ANSI/ASSE 1018. PPP Model PR-500 with Model DU-2, 3 or 4 distribution unit.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Rough bronze for units used with pipe or tube that is not chrome finished.
8. Access Panel for Concealed Trap Primer: J.R. Smith #4767 12" x 12" flush with wall type, door Type 304 stainless steel with No. 4 finish.
9. Style and Application:

   a. Single drain up to 3 drains: Pressure drop activated brass trap seal primer with inlet opening of 3/4 inch (13) male N.P.T. and outlet opening of female 1/2 inch (13) N.P.T. complete with four view holes and removable filter screen. Serves up to 3 floors drain traps and requires no adjustments and no air pre-charge; MIFAB® Model M2-500 or approved equivalent.
   b. Serves up to 6 drains: Pressure drop activated brass trap seal primer with inlet opening of 1/2 inch (13) male N.P.T. and outlet opening of female 1/2 inch (13) N.P.T. complete with four view holes and removable filter screen and requires no adjustments and no air pre-charge; MIFAB® Model M2-500 or approved equivalent.
   c. Serves up to 6 drains: Pressure drop activated brass trap seal primer with inlet opening of 1/2 inch (13) male N.P.T. and outlet opening of female 1/2 inch (13) N.P.T. complete with four view holes and removable filter screen; MIFAB® Model M2-500 or approved equivalent.

10. Accessories: Air gap copper air gap fitting complete with a ½ inch (13) male N.P.T. fitting at the inlet supply incorporating a stream directing nozzle, a 1/2 inch (13) N.P.T. female outlet and a 1 inch (25) vertical air gap, conforming to ANSI/ASME A112.1.2 air gap in plumbing systems standard: "MI-GAP" by MIFAB® or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 220500 - Common Work Results for Plumbing for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with valve. Install pressure gauges on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and solenoid valve.

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

I. Install water hammer arresters in water piping according to PDI-WH 201.

J. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Section 260526 - Grounding and Bonding for Electrical Systems.

C. Connect wiring according to Section 260519 - Low-Voltage Power Wire and Cable.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Section 221329 - Sanitary Sewerage Pumps.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 15 psi.
2. Sanitary Sewer, Force-Main Piping: 50 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and as required by authority having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 - Piping Applications Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301. All pipe and fittings shall be marked with CISPI's collective trademark or receive prior approval by the engineer of record.

B. Couplings: CISPI 310.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, FM 1680, Class 1, and ASTM C 564, rubber sleeve for sanitary drainage over recovery rooms and intensive care units.

a. Manufacturers:

1) Clamp-All Corp.
2) Mission Rubber Co.
3) Husky Couplings
4) Or equal.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

1. Steel Pipe Nipples: ASTM A 733 made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

B. Form: Sheet or tube.

C. Color: Black.

2.6 ACID RESISTANT PVC PIPE AND FITTINGS

A. Provide on all Water Supply Box (WSB-1) outlets and up to connection to sanitary waste pipe.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section - Earth Moving for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 2 and larger shall be:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints, FM approved.

C. Aboveground, vent piping NPS 2 and larger shall be:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and hubless-coupling joints, FM approved.

D. Underground, soil and waste piping shall be:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and couplings and hubless-coupling joints, FM approved.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Section 220500 - Common Work Results for Plumbing.

B. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section - Common Work Results for Plumbing.

F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: Slope downward in direction of flow for piping as required by code and authority having jurisdiction.

2. Vent Piping: Install per code or per authority having jurisdiction.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Section 220500 - Common Work Results for Plumbing.

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Section 220529 - Hangers and Supports for Plumbing Piping and Equipment. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 feet and less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.
    c. Longer than 100 feet, if indicated: MSS Type 49, spring cushion rolls.

B. Install supports according to Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

C. Support vertical piping at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inchrod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main or sanitary manhole.
2. Sewage Pumps: To sewage pump discharge.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Floor sinks.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.

B. Related Sections include the following:

1. Division 22 Section Storm Drainage Piping Specialties for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product data: Provide product description and manufacturer's installation instruction.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Vertical and Horizontal Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Brass plug.
6. Closure Plug Size: Same as cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Inside calk, Hubless or Neo-Loc.
7. Closure: Bronze plug.
8. Adjustable Housing Material: Cast iron.

9. Frame and Cover Material and Finish: Polish Bronze.
10. Frame and Cover Shape: Round.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Closure Plug Size: Same as cleanout size.
5. Wall Access: Round, Stainless Steel.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Area, Floor drain.
4. Body Material: Cast-Iron.
5. Seepage Flange: Required.
6. Outlet: Bottom.
7. Top or Strainer Material: Nickel bronze.
8. Top of Body and Strainer Finish: Polished Nickel bronze.
9. Top Shape: Round.
10. Dimensions of Top or Strainer: See drawings.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.
13. Trap Features: Trap-seal primer valve drain connection.
14. Provide fireproofing on the underside of floor drain/floor sink located above basement level.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, hubless outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 220500 - Common Work Results for Plumbing for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

    a. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install through-penetration firestop assemblies at floor penetrations.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

L. Install chrome plated escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect wiring according to Section 260519 - Low-Voltage Power Wire and Cable.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Oil interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 - Identification for Plumbing Piping and Equipment.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Interceptors.
7. Electric water coolers.
8. Water closets.
9. Lavatories.
10. Commercial sinks.
11. Service sinks.
12. Owner-furnished fixtures.

B. Related Sections include the following:

1. Division 10 Section - Toilet, Bath, and Laundry Accessories.
2. Division 22 Section - Domestic Water Piping Specialties for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 101-336, "Americans with Disabilities Act" and California Access Compliance Reference Manual for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
4. Stainless-Steel Residential Sinks: ASME A112.19.3.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Brass Waste Fittings: ASME A112.18.2.
4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. ASSE 1008 and UL 430.
2. Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Hot-Water Dispensers: ASSE 1023 and UL 499.
7. Off-Floor Fixture Supports: ASME A112.6.1M.
8. Pipe Threads: ASME B1.20.1.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, sensor operated, battery powered, 0.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
b. Zurn.
c. Or equal.

2.2 SINK FAUCETS

A. Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, battery powered, 1.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
b. Zurn.
c. Or equal.

2.3 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Sloan Valve Company.
b. Zurn Plumbing Products Group; Commercial Brass Operation
c. Or equal.

2.4 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Olsonite Corp.
b. Zurn.
c. Or equal.

2. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic.
b. Configuration: Open front without cover.
c. Size: Elongated.
d. Hinge Type: SC, self-sustaining, check.
e. Class: Extra Heavy-duty commercial.
f. Color: White.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Trubro
b. McGuire Manufacturing Co., Inc.
c. Zurn.
d. Or equal.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Or equal.

B. Water-Closet Supports:

1. Description: Reuse existing water closet carrier for wall hung water closet, if it is damaged, then provide new carrier that fits in the existing wall space, min. load to be 500 lb. Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single, vertical or horizontal, hubless waste fitting as required for piping arrangement; faceplates; cast iron couplings with gaskets; feet; and fixture bolts and hardwired matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

C. Lavatory Supports:

1. Description: Lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 WATER CLOSETS

A. Water Closets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Zurn Plumbing Product Group
   b. American Standard Companies, Inc.
   c. Kohler Co.

2. Description: Wall-mounting or floor mounted, back-outlet or bottom outlet, vitreous-china fixture designed for exposed flushometer valve operation.

   a. Style: Flushometer valve.

      1) Bowl Type: Elongated with siphon-jet design.
      2) Design Consumption: 1.28 gal./flush.
      3) Flush valves, exposed, sensor operated, battery powered.
      4) Color: White.

2.8 LAVATORIES

A. Lavatories, Wall hung:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. American Standard Companies, Inc.
   b. Corian
   c. Zurn Plumbing Products Group.

2. Description:

   a. Wall-mounting, vitreous-china fixture. With single goose neck faucet, sensor operated, battery powered with under counter thermostatic mixing valves, with non-aerator spout.
   b. Countertop: Corian seemed under mount lavatory, coordinates with corian vanity top, model Corian 810 or approved equal

2.9 COMMERCIAL SINKS

A. Commercial Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Elkay Manufacturing Co.
   b. Just Manufacturing Company.

2. With single goose neck faucet, sensor operated, battery powered with under counter thermostatic mixing valves, with non-aerator spout.

2.10 SERVICE SINKS

A. Service Basins:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Florestone Products Co., Inc.
   b. Stern-Williams Co., Inc.
   c. Or equal.

2. Description: Flush-to-wall, floor-mounting, precast terrazzo fixture with rim guard.
3. Faucet: wall mounted, manual with ADA blade handles, wall bracket, with integral service stop, check valve and in line vacuum breaker, chrome finish.

2.11 Plumbing Fixtures Schedule

A. Clinic Service Sink - CSS-1 - Clinical Sink

1. Fixture: American Standard, model 9512.999.020, clinic service sink or equal, wall mounted, blowout action, 1-1/2 inch top spud, vitreous china, integral flushing rim, stainless steel rim guard.
2. Faucet/Flush Valve Assembly: Sloan Royal Service Sink flushometer for 1-1/2" top spud, model 117, with bedpan washer, and service sink faucet, American Standard, model 8355.110 exposed yoke wall-mount utility faucet with vacuum breaker, integral service stops, and check valves, chrome plated, or equal.
3. Carrier: Floor mounted foot support, heavy duty for wall mounted fixture, by J.R. Smith model 0915 or equal.

B. Electric Hi/Low Water Coolers (ADA) - EWC-1

1. Fixture: Elkay no lead Versatile Bi- level Filtered LZ cooler, wall mount, Barrier-Free Refrigerated Fountain with EZH20 Bottle Filling Station, model LZSTL8WSSK-VR, or equal, , quick fill rate 1.1 gpm, laminar flow, stainless steel finish, Vandal-resistant bubbler head, pushbar activationin-line filter, ADA compliant. Meet NSF 61 and no lead law.
2. Cooler Section115V/60Hz .
3. Trap: 1-1/4 inch by 1-1/2 inch P-trap,
4. Supplies: Angle stop and riser.
5. Unit includes Elkay Water Sentry Plus Lead Reduction and Sediment-Taste-Odor Filter kit, model EWF 3000 and 51300C, with visual filter monitoring.

C. Lavatory - L-1 (ADA) countertop.

a. Fixture: Countertop: Corian seamed under mount lavatory, coordinates with Corian vanity top, model Corian 810 or approved equal

2. Faucet: Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, sensor operated, battery powered, 0.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Drain: Grid strainer drain.
4. Trap: 1-1/4 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
5. Supplies: Angle stops and 3/8-inch flex risers.
6. Plumbing Safety Cover: ADA insulation kits, by Truebro or equal.

D. Lavatory - L-2 (ADA) wall hung.

1. Fixture: American Standard, Lucerne or equal, single hole, wall mounted, vitreous china, self-draining back with back and side splash shields ADA compliant.
2. Faucet: Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, sensor operated, battery powered, 0.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Drain: Grid strainer drain.
4. Trap: 1-1/4 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
5. Supplies: Angle stops and 3/8-inch flex risers.

6. Carrier: Zurn Series 1200 floor mounted foot support for wall mounted fixture.
7. Plumbing Safety Cover: ADA insulation kits, by Truebro.

E. Mop Sink - MS-1

1. Fixture: Florestone Model 95 or equal 36 inch by 36 inch by 18 inch Terrazzo mop receptors with stainless steel caps, custom drain location based on building structure interference.
2. Faucet: American Standard, model 8355.110, exposed yoke wall-mounted utility faucet, with hose end, integral service stops, check valves, wall brace, vacuum breaker spout, 3/4 inch hose end, and blade handles.
3. Drain: 3 inch drain with removable chrome strainer plate.

F. Sink - SK-1 (ADA), countertop

1. Fixture: Elkay Lustertone single bowl stainless steel sink, model LRAD1919 or equal, seamless die-drawn construction of Type 304, 18-8 stainless steel, 18 gauge, 16 inch by 13.5 inch by 6 inch bowl, bowl and faucet deck recess, fully coated underside to dampen sound and prevent condensation. ADA compliant.
2. Faucet: Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, battery powered, 1.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Drain: 304 stainless steel grid strainer.
4. Trap: 1-1/4 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
5. Supplies: Angle stops and 3/8-inch risers.
6. Insulate P-traps, CW and HW supplies with Brocar Products, Inc. with 1 Kit C500R, Truebro, or equal.

G. Sink - SK-2 (ADA), - staff lounge

1. Fixture: Elkay Lustertone single bowl stainless steel sink, model LRAD1919 , seamless formed of Type 304, 18-8 stainless steel, 18 gauge, 16 inch by 13.5 inch by 6.5 inch deep bowl, bowl and faucet deck recess, fully coated underside to dampen sound and prevent condensation. Locate drain in center rear of sink.
2. Faucet: Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, battery powered, 1.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Trap: 1-1/2 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
4. Supplies: Angle stops and 3/8-inch risers.
5. 304 stainless steel basket strainer.
6. Insulate P-traps, CW and HW supplies with Brocar Products, Inc. with 1 Kit C500R, Truebro, or equal.

H. Sink - SK-3 (ADA), wall hung

1. Fixture: Just institutional Group model A-33338 or equal, seamless welded construction of Type 304, stainless steel, 18 gauge, 16 inch by 11.5 inch by 5 inch deep bowl, with integral-formed apron and backsplash. Exposed surfaces polished with Hand-Blended Just Finish. Underside coated.
2. Faucet: Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, battery powered, 1.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Standard Lavatory drain for Just J-115-FS drain.

4. Trap: 1-1/2 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
5. Supplies: Angle stops and 3/8-inch risers.
6. Insulate P-traps , CW and HW supplies with Brocar Products, Inc. with 1 Kit C500R, Trubro, or equal.

I. Sink - SK-4 small sink in Ultrasound rooms

1. Fixture: Elkay LR1316 or equal, formed of Type 304, 18-8 stainless steel, 18 gauge, 10 inch by 10 inch, 7-5/8 inch bowl, faucet ledge,.
2. Faucet: Chicago Faucets, Electronic-DC Faucets, model 116.203.AB.1, single supply for tempered water, battery powered, 1.5 gpm Non-aerating spray outlet, with ECAST thermostatic mixing valve model 131-ABNF.
3. Trap: 1-1/2 inch by 1-1/2 inch cast brass adjustable P-trap, chrome plated.
4. Supplies: Angle stops and 3/8-inch risers.

J. Sink - SK-5 Utility sink

1. Fixture: Elkay Rigidbilt single compartment Scullery sink, model RNSF8118, or equal, 27 inch by 18 inch by 12-3/4 inch bowl, with 8” high backsplash, standalone on 4 SS tubular legs, no drain boards. NSF certified.
2. Faucet: American Standard, model 8355.110, exposed yoke wall-mounted utility faucet, with hose end, integral service stops, check valves, wall brace, vacuum breaker spout, 3/4 inch hose end, and blade handles.
3. Drain: LK 24RT drain.

K. Water Closet - WC-1 (ADA,1000 lbs) - Public and Staff Restrooms

1. Fixture: Zurn Z5645-BWL, EcoVantage, floor mounted, back outlet, or equal, 1.28 gpf, 1-1/2 inch top spud inlet, flush valve type, elongated bowl, vitreous china.
2. Flush Valve: Sloan Royal Model single flush, side mount, flushometer, model 111-1.28 SFSM for 1-1/2” top spud, Sensor operated flush valve, battery powered, 1.28 gpf.
3. Seat: Solid heavy duty plastic open front seat, elongated, white, concealed check, stainless steel self-sustained hinge.

L. Water Closet - WC-2 (ADA, 1000 lbs) Public Toilet 1B014

1. Fixture: Zurn Z5665-BWL, floor mounted, bottom outlet, or equal, 1.28 gpf, 1-1/2 inch top spud inlet, flush valve type, elongated bowl, vitreous china.
2. Flush Valve: Sloan Royal Model single flush, side mount, flushometer, model 111-1.28 SFSM for 1-1/2” top spud, Sensor operated flush valve, battery powered, 1.28 gpf.
3. Seat: Solid heavy duty plastic open front seat, elongated, white, concealed check, stainless steel self-sustained hinge.

M. Water Closet - WC-3 (ADA, 500 lbs) - male stuff Restroom

1. Fixture: Zurn Z5615-BWL, wall hung, replace existing water closet with low flow 1.28 gpf, 1-1/2 inch inlet, flush valve type, elongated bowl, vitreous china.
2. Flush Valve: Sloan Royal Model single flush, side mount, flushometer, model 111-1.28 SFSM for 1-1/2” top spud, Sensor operated flush valve, battery powered, 1.28 gpf.

3. Seat: Solid heavy duty plastic open front seat, elongated, white, concealed check, stainless steel self-sustained hinge.
4. Reuse existing water closet carrier in wall, or replace with new matching ones if it is damaged or less than ideal condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
4. Water closet floor mounted carriers shall be attached to floor slab with attachment bolts penetrate through floor slab and washers and locking nuts.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install counter-mounting fixtures in and attached to casework.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section - General-Duty Valves for Plumbing Piping.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section - Common Work Results for Plumbing.

Q. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section - Common Work Results for Plumbing.

R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section - Joint Sealants.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section - Grounding and Bonding for Electrical Systems.

D. Connect wiring according to Division 26 Section - Low-Voltage Electrical Power Conductors and Cables.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 226000 - MEDICAL GAS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping, valves, alarms, auxiliary devices, installation and testing requirements for medical gas systems including, but not limited to, the following:

1. Medical Air System.
2. Oxygen System.
3. Medical Vacuum System.
4. Waste Anesthetic Gas Disposal.

1.2 REFERENCES

A. California Plumbing Code, 2013 edition

B. NFPA 99, Standard for Health Care Facilities, 2012 Edition.

C. NFPA 55, Standard for Health Care Facilities, 2012 Edition.

D. CGA Pamphlet P-2.1, Medical/Surgical Vacuum Systems.

E. CGA Pamphlet G-4.1, Cleaning Equipment for Oxygen Service.

F. CGA Pamphlet G-7, Compressed Air for Human Respiration.

G. CGA Pamphlet G-7.1, Commodity Specification for Air.

H. ANSI/AWS A5.8, Specification for Filler Metals for Brazing.

1.3 SUBMITTALS

A. Provide submittals in accordance with provisions of Section 01300 - SUBMITTALS.

B. Submit testing agency certification.

1.4 COORDINATION

A. Testing agency shall coordinate with the bulk oxygen supplier relative to that system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Piping Specialties:

1. Chemetron by Allied
2. Beacon Medaes
3. Or Equal.

B. Alarm Systems

1. Chemetron
2. Beacon Medaes
3. Or Equal

2.2 PIPING AND ACCESSORIES

A. Piping: Seamless copper pipe, ASTM B 819, Type K annealed for underground use and Type L hard drawn above ground, reamed free of burrs to full inside diameter, with chips removed.

B. Fittings: Wrought copper joint pressure type per ANSI B16.22, ASTM B 88, suitable for brazing.

C. Certification: Provide piping, valves, and fittings factory cleaned, inspected, tested, packaged and labeled in accordance with CGA Pamphlet G-4.1, certified accordingly in writing. Deliver written certification to the Architect prior to the start of installation.

D. Piping System Joining Processes: As recommended by manufacturer of pipe and fittings.

1. Pass a sufficient continuous flow of oil - free dry nitrogen through the piping during the brazing procedure to ensure that oxides of copper do not form anywhere inside the medical gas system.
2. Brazing shall be performed by brazers certified to AWS B2.2.

E. Joints: Joints shall be made using minimum 1000 degree F melting temperature, BCUP brazing filler without flux, and shall comply with AWS A5.8.

2.3 QUICK-CONNECT RECESSED WALL OUTLETS

A. Outlets: Chemetron by Allied, 500 series Quick-Connect Medical Gas Outlets (64-01-5001P, 64-01-5002P, 64-01-5003P AND 64-01-5006P), provided for oxygen, vacuum, medical air, and WAGD services, UL listed conforming to applicable NFPA 99 and CGA Standards. Outlets shall consist of separate rough-in and finish assemblies of modular design.

B. Rough-in Assembly: Corrosion resistant with a secondary check valve and a specific gas pin keying system which shall allow pressure testing without additional labor to remove plug or adapter after testing.

C. Finishing Assembly: Includes a primary check valve, pin key indexing, designed to assure absolutely no gas flow until proper adapter is fully engaged. Color coding and appropriate cover plates shall be provided. Vacuum outlets shall have adjacent slides for bottle support.

2.4 AREA/ZONE VALVES

A. General: Recess valves in wall boxes constructed of extruded aluminum having an anodized window frame with mitered welded corners, shatter resistant easily removable window with emergency pull ring, appropriately labeled. A closed valve prevents the installation of the window.

B. Valves box assemblies: Chemetron by Allied, Three-Valve Zone Valve Boxes model 77-83 -03XX. Complies with NFPA 99. Full port valves, 18 gauge steel valve box, with factory installed copper tubing extension. Provide line pressure monitoring gauges accordingly. Color code and label each valve to identify its service.

C. Multiple Valves: Housed within a single box for three services (MV, MA and O2).

2.5 AREA/ZONE ALARMs

A. Area/zone Alarms: Amico, Alert-3 LCD Area Alarm system. The LCD alarm shall be microprocessor based with a 10” screen, auto detecting gas specific sensors shall be mounted locally by installing the copper pipe provided or mounted remotely, UL approved, comply with NFPA 99 (2012), audio-visual. Self-diagnostic and error message display. Compactable to NMC BMS system.

1. Open circuit alarms which do not monitor alarm signal wiring integrity will not be acceptable.
2. Area/zone alarms shall be provided per NFPA 99.

B. Rough-in Assembly: Provide self-sealing check valves for easy removal of finish assembly to facilitate servicing without system shut down.

C. Electrical Work: primary power design accept 115 and 230 VAC, 60 Hz power provided under Division 16. Provide medical gas alarm and interlock signal wiring electrical work under this Section, refer to Drawings.

D. The 4 gas area/zone alarm panels shall be compatible for connecting to the existing oxygen, medical air and medical vacuum pressure sensor connection points.

PART 3 - EXECUTIon

3.1 WORKMANSHIP

A. Degrease, clean, dehydrate, and cap pipe for medical gas usage, per CGA Pamphlet G-4.1. Piping shall be reamed and deburred at all connections.

B. Daily label piping as to gas service during erection to maintain continuity and system integrity.

C. Confirm final connections to equipment to assure that no cross-connections exist.

3.2 MEDICAL GAS ALARM WIRING

A. Provide medical gas alarm wiring diagrams. Electrical work required for 120 volt, 60 Hz power, and emergency power shall be provided under Division 16. Provide signal wiring electrical work under Division 15. Electrical work shall not be started until complete wiring diagrams have been made available for use by parties concerned.

3.3 TESTING

A. Provide gases necessary to complete testing procedures through to certification. Installer performance testing shall include blow down, initial pressure test, cross connection test, piping purge test and standing pressure test.

B. Complete and test pipe rough-in accordance with NFPA 99 before any finish work is applied. Covering of work before acceptance is prohibited. Certify system testing completion to Architect.

C. Medical gas systems, including source equipment, valving, alarms and use point outlets shall be evaluated and certified for mechanical and therapeutic function as defined by NFPA 99, CGA Pamphlet P-2.1, and state and local authorities having jurisdiction thereto.

1. This testing shall be performed by an agency independent of the facility, contractor or their suppliers.
2. The agency shall specialize in medical facilities and shall be able to demonstrate experience and expertise in medical gas installations.
3. The testing agency shall be hired by the Owner and be supported by the Contractor throughout the testing period.

3.4 The agency shall provide the facility full documentation of the following:

A. That all medical gas systems as constructed follow guidelines of NFPA 99, regarding placement and applicability of valves, alarms, and source equipment. the agency shall not be responsible for evaluation of plumber's technique in such elements as routing and hangers except as required by paragraphs that follow.

B. That no cross-connections exist in pipelines as constructed. Documentation shall include examination of the outflow of each outlet, following NFPA 99 mechanical cross-connect procedures. Additionally, examine each outlet outflow with an appropriate analyzer and document concentrations. Include oxygen, medical air, and vacuum systems in the mechanical examination.

C. That all outlets are delivering gas at a pressure and flow consistent with anticipated needs, as defined by responsible authorities within the facility, but in no case less than CGA or NFPA guidelines.

D. That the pipelines are free of debris, including liquid.

E. That all outlets are functional.

F. That delivered gas purity complies with applicable CGA/USP and NFPA-99. specifications for breathing gas.

1. Take samples from each station outlet for oxygen, and medical compressed air, and test with an oxygen analyzer to confirm the presence of the desired percentage of oxygen.
2. Evaluate samples against CGA/USP requirements for human use and compare to one another.

    a. 3.Gaseous hydrocarbons.

G. That reserve source equipment and its control equipment is in place and operational.

H. That valves are functional. Document the location of control zones without regard to plans. Compare documentation with as-built plans and report discrepancies between the actual installation and the plans to the Owner.

I. That all alarms are set and functioning in accordance with NFPA 99. The surveillance areas of each shall be documented and compared per 3.3.D.8 above.

J. That medical air is dry. The examination shall consist of a dewpoint reading taken at source and most distant outlet of each lateral branch. Document temperatures and pressures affecting dryness.

K. That systems bear appropriate labels in accordance with NFPA 99.

L. Documentation shall be provided by the testing agency to the owner and contain the above information as the certification. These documents become part of the facility's permanent records. Certification shall be provided upon successful completion of tests. The Contractor shall not be released from contractual obligations until certification is obtained.

END OF SECTION 226000

SECTION 230500 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes the general requirements for materials, fabrication and installation of the Work specified in all other Sections in Division 23, Mechanical.

B. It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation. Any apparatus, appliance, material or work not shown on Drawings, but mentioned in the Specifications or vice versa, or any incidental accessories necessary to make the work complete and ready for operation, even if not particularly specified, shall be provided without additional expense to the Owner. Should there appear to be discrepancies or questions of intent in the Contract Documents, refer the matter to the Architect for his decision, before ordering any materials or equipment or before the start of any related work. The decision of the Architect shall be final, conclusive and binding.

C. Drawings and Data:

1. Drawings are generally diagrammatic and are intended to convey scope of work and to indicate general arrangement of equipment, ducts, conduits, piping and fixtures. They are not intended to show every offset or fitting or every structural difficulty that may be encountered during installation of the work. Location of all items not definitely fixed by dimensions is approximate only. Exact locations necessary to secure best conditions and results must be determined at Project and shall have approval of Architect before being installed. Do not scale Drawings.
2. If so directed by Architect, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of other trades or for proper execution of work.
3. Include minor details not usually shown or specified, but necessary for proper installation and operation of a system or piece of equipment in work and in bid price, the same as if specified or shown.

D. Related Sections of Work: Schedule and coordinate Work with that of other Divisions and Sections to execute the Contract expeditiously and avoid unnecessary delays.

1. Building Systems Commissions: See Division 01.
2. Concrete, except as part of an inertia base. See Section 033000.
3. Wall louvers with bird screens: See Division 08.
4. Undercutting of doors, door louvers: See Division 08.
5. Electrical (except as specifically indicated): See "Electrical" Division 26.
6. Painting (except as specifically indicated): See "Painting" Division 09.
7. Fire extinguishers and cabinets not part of fire protection system. See Section 104400.

8. Structural steel (except as specified herein) See Division 05.
9. Accessories including soap dispenser: See Division 10.
10. Power conduit and wiring for Plumbing, and HVAC (except as specified herein): See "Electrical" Division 26.
11. Thermal and sound insulation in partitions and ceilings: See Division 07 and Division 09.
12. Patching and paving: Division 02.
13. Utilities 5 feet beyond building line unless noted otherwise: See Division 02.
14. Description of architectural access doors: See Division 08. Furnishing of access doors by Division 23. Installation by Division 09.
15. Building firestopping and smoke seals: See Division 07.

1.2 references

A. The General Conditions, Supplementary conditions, and applicable portions of Division 01 apply to the work of this Section as if printed herein.

B. This Section applies to the Work of all Sections under Division 23.

1.3 definitions

A. "Piping" includes, in addition to pipe, all fittings, nipples, flanges, valves, unions, hangers and other accessories related to such piping.

B. "Wiring" includes, in addition to conductors, all raceways, conduit, fittings, boxes, switches, hangers and other accessories related to such wiring.

C. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings or embedded in construction.

D. "Exposed" means not installed underground or "concealed" as defined above.

E. "Regulating Authorities" means all governmental, utility and fire protection authorities having jurisdiction.

F. "Provide" means to supply, erect, install and connect up completely, in readiness for regular operation, the particular work referred to.

G. "Furnish" means to supply and deliver to the job, install as indicated.

H. "Approved Equal" means any equipment or material which in the opinion of the architect, is equal in quality, durability, appearance, strength, design and performance to the equipment or material specified and will function adequately in accordance with the general design.

I. "Singular Number": Where any device is herein referred to in the singular number, such reference shall be deemed to apply to as many such devices as are required to complete the installation or as many as are shown.

1.4 SUBMITTALS

A. General:

1. This section provides more detailed requirements that apply to Division 23 only and take precedence over Division 1 requirements on matters specified herein.

1.5 Submittal literature, drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item. Submittals shall include, but not be limited to those items listed in individual Sections and the following:

Substitutions: In accordance with Division 00.

Pipe and Trim	Terminal Air Boxes Air Outlets Access Doors (with a detailed list insulation, including room numbers)
Chillers	Filters
Terminal Air Units	Vibration Isolators
Temperature Controls	Hangers and Seismic Bracing
Fan Coil Units	Fire Protection Equipment, Shop Drawings and Hydraulic Calcs
Steam and Condensate Equipment	

1. Material VOC Content: Submit manufacturer's printed product data sheets and/or letters of certification on the manufacturer's letterhead for all adhesives, sealants, paints and coatings with evidence that they conform to the "Sustainable Design Quality Assurance" article of this Section for VOC content.

a. Highlight the VOC data for the material in grams per liter.
b. List the quantity of material to be used in gallons or liters.

B. Submit Shop Drawings, supplemental data, for all materials, equipment in all Sections of this Division in accordance with the requirement of Section 013300 and as specified.

C. Forward all complete submittals to the Architect. Incomplete submittals are not acceptable and will be returned without review. Contractor is responsible for any resultant consequence and expenses, including time to and costs associated with re-submittals.

D. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.

E. Identify each submittal item by reference to Specification Section paragraph in which item is specified or Drawing and Detail number. Mark identification numbers appearing on the equipment schedule.

F. Submittals will not be reviewed without prior stamp and sign-off by General Contractor and subcontractor.

G. Organize submittals in same sequence as they appear in specification sections, articles or paragraphs.

H. Submittals which combine equipment or materials from separate unrelated sections will not be accepted.

I. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, weight.

1. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of the Contract Documents.
2. Draw Drawings to scale and dimension (except piping diagrams not to scale). May be prepared by vendor but submit as instruments of Contractor. Thoroughly check and stamp by Contractor before submission to Architect for review.
3. Catalog cuts and published material may be included to supplement scale drawings.

J. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item. Submittals shall include, but not be limited to those items listed in individual Sections.

K. Manufacturer's Certificate of Performance and Construction:

1. The equipment listed by model number and manufacturer in the plans and specifications has been selected for its capacity, certain standard construction features and specified optional features.
2. When requested, the Contractor shall obtain a certificate signed by an authorized representative of the manufacturer certifying that:

    a. The manufacturer has reviewed the performance requirements specified and scheduled.
    b. The manufacturer is cognizant of the standard and optional features of the specified equipment.
    c. The manufacturer warrants that the equipment fully meets items (a) and (b) above; or
    d. The manufacturer has listed in detail all exceptions to items (a) and (b) above.

3. In addition to the above items, when requested, the manufacturer shall furnish copies of current published performance data with specified conditions indicated and interpolations performed. Mere listing of specified performance conditions will not be acceptable.
4. Failure to completely comply with the requirements of this Section of the specifications shall be sufficient cause for final rejection of the proposed equipment.

L. Substitutions:

1. Certain products are specified without equals. Substitutions for those will not be considered.
2. Contractor is responsible for OSHPD documentation preparation (i.e., change orders) on approved substitutions.
3. Where manufacturers' names are specified, first named is basis of design. Contractors shall be responsible for modifications to piping, electrical, structural systems, seismic calculations, etc., for other than basis of design selections. Other manufacturers other than first three named will be considered substitutions. Substitutions are acceptable provided the following conditions are met:

    a. Only one submission of a manufacturer other than first named will be considered; further resubmission of rejected manufacturer or any other manufacturer other than first named is not permitted.
    b. Submit all data necessary, in table of comparison listing pertinent features of both specified and proposed materials, to show the equipment is equal to first named specified including model number, capacities, materials, dimensions, weights, required connections (piping, electrical, etc.), tube removal, maintenance access, etc. Provide itemized listing of similarities and differences. Rejection requires material be submitted as first named manufacturer. Insufficient information will cause immediate rejection.
    c. In Architect's opinion, overall value to Owner will not be reduced. Decision of Architect is final.
    d. Submit formal request for substitution including all requirements specified in this section. Clearly indicate when item is substituted for first named manufacturer. Lack of formal request will result in rejection.
    e. Substitution cannot cause substantial revision of Contract Documents. List changes required in other work and products.
    f. Perform a thorough check of all interferences, revised arrangements and other changes that may result. Furnish drawings of revised arrangements equal in quality to the Contract Drawings. Be responsible for making any changes in arrangement to work affected under other sections at no increase in contract sum.
    g. If, in Architect's opinion, submitted manufacturer affects system design or the required size or capacity of other equipment, piping, electrical work, etc., make all necessary and related changes as directed by Architect. Additional engineering and sizing will be done by the Architect's Engineer at Contractor's expense.

h. Submit manufacturers other than first name only after adequate investigation to assure equivalence. Do not delegate responsibility to suppliers. Examine equivalents from point of view of the Owner including quality of manufacture, satisfactory service and spare ports availability, economy of operation and similar factors.
i. If manufacturer other than first named is accepted by Architect, responsibility for its full compliance with Contract Documents and applicable codes remains with the Contractor. Acceptance by Architect does not imply acceptance of any deviations from the requirements of the Contract Documents.
j. Submit accurate cost data comparing proposed substitution with first named product specified. Include in submittal dollar amount to be credited to Owner by change order if manufacturer other than first named is accepted. Item not acceptable if there is no credit or if credit is inadequate. Simple assertion that product is equal in cost, is substituted because of contractor-supplier relationship, already gave back cost differential during bid, etc., is not acceptable.
k. Submit data relating to changes in construction schedule.
l. Evaluation of proposed substitutions may be time consuming process. No extension of contract time will be granted owing to untimely submission, review or rejection.
m. Contractor assumes full responsibility for any and all problems and delays arising from use of the substitute item or material.

M. Resubmittals:

1. Resubmittals will be reviewed for compliance with comment made on the original submittal only. Clearly identify replied-to comments with a resubmittal number and date.
2. Indicate dates of previous submissions and submittal numbers.
3. Direct specific attention to any changes made in addition to those made in reply to previous review comments.

N. Shop Drawings:

1. Shop fabrication, coordination and installation. Drawings that are prepared to scale by the Contractor, are for his use and shall be his responsibility. These Drawings indicate where he intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not permitted.
2. No technical review of shop drawings will be undertaken where not specifically requested in other sections. Where submittal is requested, drawings are required as evidence that work is planned, and that complete coordination of systems and resolution of conflicts or inconsistencies has been performed by the Contractor as required by these specifications. Shop drawings will be retained for file and not returned.

3. Prepare and submit Shop Drawings for all Work in "tight" areas, indicating solutions to space problems and coordination with Work in other Sections. Clearly identify these areas (clouding, etc.). These Drawings, as a requirement of this Division, shall indicate, superimposed, Work of all Sections involved in congested area, including ductwork, piping, electrical work, ceiling work, etc. Include all mechanical rooms. Identification of space problems without solutions is not acceptable.
4. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of his Work with that of all other trades and the satisfactory performance of his work.

O. Certificates:

1. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.
2. Machinery vibration test reports.
3. Certificates of sterilization/chlorination of plumbing systems.
4. Test certificates.
5. Instruction certificates.
6. Fire Marshal and/or Fire Department approvals of system.
7. Final inspection certificate signed by governing authorities.
8. Piping mechanical grooved joint instruction certification.
9. Underground pipe insulation instruction certification.
10. Others as specified herein and as required.

P. Operating and Maintenance Instructions and Manuals: In accordance with requirements of Section 017823 and as follows:

1. Subsequent to completion of balancing, testing operations, this Division is responsible for instructing the Owner's authorized representatives in operation, adjustment and maintenance of mechanical plant and other mechanical equipment. Submit three copies of certificate, signed by Owner's representative, attesting to their having been instructed.
2. Final punchlist will not be started until manuals are approved by the Owner's Representative.
3. Instructions on major items such as pumps, air compressors, water heaters, vacuum pumps, sewage ejectors, fans, air handlers, AC units, and temperature control shall be by representative of manufacturer of respective equipment.
4. One month before Owner's personnel assume operation of systems, submit eight sets of operating and maintenance instructions and manuals including the following:

    a. Names, addresses and phone numbers of contractors and subcontractors and of local representatives, service facilities and normal channel of supply for each item in equipment.

b. Complete operating and maintenance instructions and parts lists of all equipment and component parts. Data sheets to show complete internal wiring, mechanical and electrical ratings and characteristics, catalog data on component parts whether furnished by equipment manufacturer or others, names, addresses and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.

1) Where data sheets included in manual cover equipment, options, or other features not part of equipment actually furnished, line out these references or otherwise clearly mark so remaining text, diagrams, drawings, schedules, and similar information shall apply specifically to equipment furnished.

c. A lubrication chart listing each item of equipment, all points of lubrication, proper lubricant, dates lubricated, and lubrication schedule.
d. Balancing reports after final test and balance of system.
e. Bind data in vinyl covered loose-leaf binders with title index tabs identifying items therein to include:

1) Typewritten detailed description of sequence of operation of each system, with charts and diagrams.

f. Submit drafts of instruction sheets to Architect for review before preparing final sets.

5. Provide full size copies of record one-line diagrams, in metal frames with glass front. Obtain record prints from Architect at Contractor's cost and have prints framed by a firm normally engaged in this work. Locate diagrams as directed.
6. Provide three control diagrams, suitably framed, with glass front. Diagrams shall show complete equipment, controls, model numbers, etc., marked to correspond to identification on equipment. Locate as directed.
7. Individual guarantees.
8. Certificates of Inspection and Instruction.

Q. Record Drawings:

1. See Division 1, Project Record Documents, for additional requirement for Record Drawings.
2. Maintain at site a set of reproducible and erasable vellum Drawings. Clearly indicate (by shading, coloring or some other acceptable method) the day-by-day extent of Work installed.
3. Clearly indicate any dimension changes in elevation, location, size or material, and offsets and valves.
4. Locate all underground, underfloor, concealed or buried piping by 2 or more dimensions per turn of pipe between each direction change. Show all elevations (invert or centerline) with the point of elevation change clearly located.
5. Number and letter valves to correspond with number and letters of valve charts.
6. Exact location, type and function of concealed valves, dampers, controllers, etc.

7. Progress drawing set to be available for review by Owner's Representative weekly.
8. At conclusion of contract work, provide the Owner's Representative with complete set of reproducible drawings with all changes clearly marked to reflect as-built conditions. Label these drawings "As-Built".

1.6 quality assurance

A. Standards:

1. Specific references:

a. Associate Air Balance Council
b. Accessibility Guidelines for the Americans with Disabilities Act
c. Air Diffusion Council - Test Code
d. American Gas Association
e. Air Moving and Conditioning Association
f. American National Standards Institute
g. Air Conditioning and Refrigeration Institute
h. American Standards Association
i. Adhesive and Sealant Council
j. American Society of Heating, Refrigerating and Air Conditioning Engineers
k. American Society of Mechanical Engineers
l. American Society of Sanitary Engineering
m. American Society for Testing and Materials
n. American Welding Society
o. American Water Works Association
p. California Code of Regulations
q. Commercial Standards - US Dept. of Commerce
r. Factory Mutual System
s. US Dept. of Health, Education and Welfare
t. Industrial Risk Insurers, One Northland Drive Building, Suite 419, 16900 West Eightmile Road, Southfield, Michigan 48075
u. Manufacturers' Standardization Society
v. National Bureau of Standards
w. National Certified Piping Welding Bureau
x. National Electric Code
y. National Electrical Manufacturer's Association
z. National Fire Protection Association
aa. Office of Statewide Health Planning and Development
bb. Plumbing and Drainage Institute
cc. Sheet Metal and Air Conditioning Contractor's National Association, Inc.
dd. Underwriters Laboratories, Inc.
ee. California Plumbing Code – 2013 Edition
ff. California Mechanical Code – 2013 Edition
gg. California Building Code – 2013 Edition

2. All Base Materials: Comply with standard of ASTM and ANSI.
3. All Gas Fired Devices: Comply with standards and bear label of AGA.
4. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.
5. All Electrical Devices and Wiring: Conform to standards of NEC. All devices: UL listed and identified.
6. All work and material shall be in full accordance with the latest rules and regulations of the California State Fire Marshal and the California State Department of Public Health; the Safety Orders of the Division of Industrial Safety; CCR Titles 8, 17, 19, 22 and 24; the California Plumbing Code and California Mechanical Code, IAPMO; the National Electric Code, National Fire Protection Association Pamphlets; OSHA; and other applicable laws or regulations. Listing and approval of Underwriters Laboratories, Inc. and American Gas Association where available and applicable.
7. Rulings and interpretations of authorities shall be considered a part of the regulations.
8. It is not the intent of drawings and specifications to repeat requirements of codes except where necessary for completeness or clarity.
9. Where the standards of the drawings and specifications for materials and/or workmanship are higher than the requirements of the documents cited above, the drawings and specifications shall take precedence; otherwise the documents shall govern.
10. Nothing in these plans or specifications is to be construed to permit work not conforming to these codes and regulations.
11. Should there be any direct conflict between the above rules and the specifications, the most stringent shall govern.
12. Charges for all materials and labor required for the compliance with these rules and regulations shall be included in the Bid Price.

B. Before bidding, be familiar with rulings of inspection departments and comply with such requirement.

1.7 Codes, Ordinances, Certificates, Permits and Fees:

A. Give necessary notices, obtain permits and pay taxes, fees and other costs in connection with work; file necessary plans, prepare documents and obtain necessary approvals of regulating authorities having jurisdiction; obtain all required Certificates of Inspection for Work and deliver to Owner's Representative before request for acceptance and final payment for Work.

B. Include in Work, without extra cost to Owner, labor, materials, services, apparatus, drawings (in addition to Contract Drawings and Documents) required to comply with applicable laws, ordinances, rules and regulations.

1.8 product delivery, storage and handling

A. Deliver equipment in its original unbroken package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction. Identifying labels intact and legible.

B. Immediately upon delivery, identify and inspect materials and equipment delivered to Site assure compliance with Contract Documents, approved submittals and reviewed Shop Drawings.

C. Protect from loss, damage, dust, water etc., until notice of completion has been filed. Promptly replace lost, damaged or defective materials and equipment with new at no increase in Contract Sum. Remove damaged or defective materials from site.

1.9 warranty

A. Conform to the requirements of Section 01 XX XX, Guaranties and Warranties.

B. Each complete system shall be warranted by the Contractor for a period of one year from date of substantial completion. Each system shall be free of defects of materials and workmanship, and shall perform satisfactorily under all conditions of load or service.

C. The warranties shall provide that all additional controls, protective devices, or equipment be provided as necessary to make the system or equipment operate satisfactorily and that any faulty materials or workmanship shall be replaced or repaired.

D. On failure of the warrantor to do the above after written notice from Owner, the Owner shall have the Work done at the cost of the warrantor at no increase in contract sum.

E. This also applies to services including Instruction, Adjusting, Testing, Noise, Balancing, etc.

F. Furnish manufacturers' warranties in excess of one year where specified and required.

1.10 job conditions and coordination

A. In accordance with Section 013100 and the following.

B. Specifications and Drawings:

1. In case of conflict, the most stringent takes precedence.

2. Not all information is included in both Drawings and Specifications. If any information is in either Drawings or Specifications it is as if the information is covered fully in both Drawings and Specifications.
3. For purposes of clarity, legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure are not shown. Coordinate dimensioned conditions including invert elevations with work of other trades prior to installation of any work of any trade.
4. Exact routing of piping, ductwork, etc. shall be governed by structural conditions, obstructions. Make use of data in Contract Documents. In addition, Architect reserves right, at no increase in Contract Sum, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Contractor to verify Architect's requirements in this regard prior to roughing-in.
5. Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the approximate location shown on mechanical Drawings.
6. Mounting heights of brackets, outlets, etc., as required.

C. Coordination:

1. Work out all "tight" conditions involving Work under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no increase in Contract Sum.
2. Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided by Contractor, his decision, if consistent with Contract Document requirements, shall be final.
3. Coordinate electrical interlocks of mechanical equipment with Division 26.
4. Provide templates, information and instructions to other Divisions to properly locate holes and openings to be cut or provided.
5. Not all offsets in ductwork or piping are shown. Contractor shall decide which item to offset or relocate. Maintain required slope in piping.

D. Large Scale Layout Drawings, prepare large scale detailed layout Drawings showing locations of equipment, piping runs, ductwork, and all other elements of mechanical systems provided under this Division. Include sections of all "tight" areas to show relative position and spacing of affected elements.

E. Equipment Rough-In and Final Connections:

1. Rough-in locations shown on Drawings for equipment furnished by Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources:

a. From Shop Drawings for Contractor furnished and installed equipment.
b. From Architect for Owner furnished-Contractor installed equipment.
c. From existing equipment where such equipment is relocated under this Contract.

2. Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Architect and provide as directed at no increase in Contract Sum.
3. Make final connections.
4. Provide pipe fittings, pipe reducers/increasers, flexible connections bushings, etc., as required for complete installation.
5. Provide ductwork accessories as required for complete installation.

F. Site Examination:

1. Examine site carefully and compare to Drawings. Call any discrepancies to attention of Architect during bidding period.

G. Review of Construction:

1. Work may be reviewed at any time by representatives of Architect.
2. Advise Architect that work is ready for review at following times:

a. Prior to backfilling buried work.
b. Prior to concealment of work in walls and above ceilings.
c. When all requirements of Contract have been completed.

3. Neither backfill nor conceal work without Architect's consent.
4. Maintain on job a set of Specifications and Drawings for use by Architect's representatives.
5. Engineer will assist Architect with field review of construction, will inform Architect regarding progress and problems related to construction, and will endeavor to guard Owner against defective materials and faulty workmanship. Engineer's reviews will be periodic, depending upon nature of construction. Engineer is not required to perform extensive or continuous inspection, is not responsible for execution of Contract Documents by Contractor, nor is he responsible for construction methods, sequences, or safety precautions.

H. Schedule of Work:

1. In accordance with Section 013200 and as follows:
2. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.
3. In scheduling, anticipate means of installing equipment through available openings in structure.

4. Before making connections or doing any work which will interrupt existing services, notify Owner, in writing, twelve working days in advance and advise duration of interruption; perform such Work as quickly as possible and only at such times designated by Owner, refer to General Conditions.

1.11 SERVICING

A. A manufacturer's representative and adequate maintenance facilities in the area are required to insure prompt servicing of all equipment installed.

PART 2 - PRODUCTS

2.1 materials and equipment

A. Materials and equipment standard products of a reputable manufacturer regularly engaged in manufacturer of the specified item. Where more than one unit is required on any item, furnish and install same manufacturer, except where specified otherwise. Install material and equipment in accordance with manufacturer's recommendations. Should variance between plans and specifications occur with these, contact Architect immediately so that variations in installation can be known by all parties concerned.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as required for fully functional system.

C. Provide BAS interface for all equipment. For packaged equipment with factory control panel. Provide remote on/off functions and alarm monitoring points. Refer to control diagrams for additional requirements. Provide compatible communication card.

D. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

E. Deliver materials or equipment to the Project in the manufacturer's original unopened, labeled containers and adequately protect against moisture, tampering or damage from improper handling or storage. Do not deliver materials to the job before they are ready for installation, unless adequate security is provided.

F. Architect may require removal from the premises of such material or Work that in his opinion is not in accordance with Specification; he will also require substitution, without delay and satisfactory Work or material.

G. Factory Applied Finishes: Repair and/or refinish work damaged by the Work of this Division, to Architect's satisfaction. Obtain finishing materials from equipment manufacturer.

H. Access Doors:

1. Furnish under this Division where shown, or required by Regulatory Agencies and for access of all concealed valves, shock absorbers, unions, fire dampers, motors, etc., even though access doors are not shown for Mechanical Work.
2. Doors shall be in accordance with requirements of Section 083113. Doors in this Division, Division 08, and Division 26 shall all be from same manufacturer for identical appearance and keying.
3. Sizes: 24 inches by 24 inches where entire body access is required, 18 inches by 18 inches where partial body access is required for ceilings and 12 inches by 12 inches minimum for walls and easily accessible items. Furnish fire rated doors where required.
4. Deliver doors for installation under Division 8. Mark each door to accurately establish its location.

I. Electrical Requirements:

1. Electrical Work in this Division shall conform to requirements of Division 26.
2. Starters: Starters included in motor control centers and all starters for motors are specified in Division 26 except starters specifically included as part of specified equipment.
3. Disconnects: Except for disconnects factory mounted on mechanical equipment, or in combination starters, motor disconnects are specified in Division 26.
4. Power wiring: Except for factory wiring on mechanical equipment, power wiring is specified in Division 26.
5. HVAC control wiring, Section 230900: Provide control conduit and wiring for all HVAC controls.
6. Fire protection system wiring: See Division 26.
7. Where Drawings clearly and explicitly differ from the two preceding wiring paragraphs, the most stringent has precedence.
8. Provide controls, controllers, relays, transformers, switches, etc., required by Work of this Division 23.
9. Factory wired assemblies and panels: Prewired to numbered terminal strips for connection to field wiring.
10. Provide disconnect switch for each control circuit connection to prewired assemblies and control panels.
11. Provide to Division 26 approved wiring diagrams for work to be connected under Division 26.
12. Provide weatherproof devices and installation for out-of-doors work.
13. Product of combustion detectors in ductwork furnished under Division 26, installed by this Division 23, and wired by Division 26 to fire alarm system.
14. Motors: Provide motors for equipment specified. Coordinate with Division 26.

2.2 special tools

A. Furnish to Owner the following:

1. One set of any special tools required to operate, adjust, dismantle or repair any equipment of this Division. "Special tools" means those not normally found in possession of mechanics or maintenance personnel.
2. One pressure grease gun for each type of grease required, complete with adapters to fit all lubricating fittings on equipment.

PART 3 - EXECUTION

3.1 examination

A. Examine fully specifications and Drawings, to become familiar with all conditions affecting Work, and consult and cooperate with other Divisions and Sections for determining space requirements and adequate clearances with respect to other equipment in the building. Architect reserves the right to determine space priority in the even of interference between piping, conduit, and equipment of various trades.

B. If Work is installed without coordinating with other trades, and such installation interferes with their installation, make any changes necessary to correct the conditions, without extra charge.

3.2 existing installation and conflicts

A. Protect existing active services (water, gas, sewer, steam, chilled water, electric) when encountered, against damage from construction work. Do not prevent or disturb operation of active services which are to remain. If Work makes temporary shutdowns of services unavoidable, consult with Owner as to dates, procedures, and estimated duration of shutdown period at least ten working days in advance of the date that the work is to be performed. The Work may require shutdowns to be accomplished on an "overtime" basis without additional cost to the Owner.

B. Arrange Work for continuous performance to assure that existing operating services will be shut down only during the time required to make necessary connections. If a system cannot shut down, install temporary bypasses or jumpers until connections are complete.

C. If existing active utility services are encountered which require relocation, make request to proper authorities for determination of procedures. Properly terminate existing services to be abandoned in conformance with requirements of authorities having jurisdiction.

D. All removed equipment shall remain the property of the Owner and stored on site as directed.

E. Where connections or disruptions are made to existing system, reactivate, refill and recharge all components and restore systems to the same operating conditions prior to the time of disruption.

3.3 installation

A. Install materials and equipment in compliance with governing codes.

B. Manufacturers' Directions: Follow in all cases where manufacturers' of articles used furnish directions covering points not specified or shown.

C. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

D. Equipment: Accurately set and level with supports neatly placed and properly fastened. Properly fasten equipment in place with bolts to prevent movement in earthquake. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in, installing equipment into position inside building.

E. Piping or Ductwork Systems: As specified in other Sections of this Division.

F. Electrical:

1. Install wiring in conduit at concealed, shafts, inaccessible and exposed locations; provide conduit.
2. Install electrical devices with code required clearances and access.

G. Equipment hook-ups: Contractor is responsible for coordination and provision of connections to main equipment including but limited to ductwork and pipe transitions, flexible connections and other fittings or devices as required for complete installation. Sizes shown on plans are not final equipment connection sizes.

3.4 temporary openings

A. Ascertain temporary openings required for admission of apparatus. Notify the General Contractor and Architect accordingly. Provide such openings at no additional cost to the Owner.

3.5 sleeves

A. Furnish and set sleeves in locations where pipes or conduit pass through floors, walls, partitions, all concrete and roof. Openings shall not impair strength, function or esthetics of the Work cut.

B. Submit shop drawing showing sleeves at all locations.

3.6 excavation and backfill

A. Perform necessary excavation, shoring and backfilling required for the proper laying of pipes and conduits inside the building and premises, and outside as may be necessary. Remove excavated materials as directed.

B. Excavation, trenching and backfill shall conform to the requirements specified in Section 023000.

C. Provide barricades, signs, lanterns, shoring, sheeting and pumping as part of work in the Division as required to ensure safe conditions. Comply with Cal-OSHA requirements.

3.7 pipe expansion, contraction, vibration

A. Install pipe connections to allow for freedom of movement of piping during expansion, contraction or vibration. Provide expansion loops, flex connections and expansion joints with proper anchors and guides as required or where shown on drawings. Anchors and guides shall be subject to review.

3.8 scaffolding, rigging and hoisting

A. Provide scaffoldings, rigging, joisting and services necessary for erection and delivery of equipment and materials provided under this Division. Remove same from premises when no longer required.

3.9 hangers, inserts, supports and bases

A. Provide and design required structural members, intermediate members, hangers, anchor bolts, supports and inserts. No power driven studs will be installed for supports unless pre approved by the Structural Engineer. Keep piping and conduit in proper alignment and prevent transmission of injurious thrusts and vibrations. Where supported from concrete construction, do not weaken concrete or post-tension strands or penetrate waterproofing. Hangers and supports shall be capable of screw adjustments after piping or conduit is erected. Hangers shall be finally adjusted in vertical and horizontal direction under operating conditions.

B. Metal deck roof systems shall not be used for the support of hangers, inserts, etc.

C. Support equipment and other mechanical items on curbs, legs or steel framework. Provide all metal bases and supports including intermediate members, not part of the building structure, unless specifically indicated to be provided under other Divisions. Materials and equipment furnished or provided under this Division shall be as described for similar work under other Divisions.

D. Concrete and masonry bases and supports are provided under other divisions of this Specification. Locate and size bases. For all equipment located on concrete floor. Base 4 inches high and extend 6 inches beyond edge of equipment base unless indicated otherwise. Furnish required foundation sizes, bolts, washers, sleeves, plates, templates, etc., for mechanical equipment provided.

E. Embed no piping in concrete or masonry.

F. Locate and size openings for ductwork through walls, roof, etc., under this Division. Framing of openings provided by respective Divisions in whose work opening is made.

3.10 manufacturer's identification

A. Manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished under this Specification. The nameplate of Subcontractor or Distributor is not acceptable.

3.11 access panels

A. Place no valves, traps, controls, unions, dampers, coils, air distribution boxes, cleanouts, junction boxes, pull boxes, expansion joints, etc., in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in systems.

3.12 painting

A. Paint all unpainted, non-insulated, non-galvanized and exterior galvanized, ferrous metal surfaces of pipes, equipment, fixtures, hangers, supports, and accessories under Painting Section 099123.

B. Paint all equipment and supports out-of-doors with two coats rust and weather inhibiting enamel.

C. Refinish Work supplied with final finish under this Division if damaged to satisfaction of Architect.

D. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this Division free from all rust, scale, dirt, grease, splashed paint, plaster, and all other dirt before any covering of painting is done, or the systems put in operation. Leave in condition satisfactory to Architect.

E. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment and materials.

F. Colors as directed by Architect unless specified herein.

G. Factory Finishes:

1. Air outlets in acoustical tile ceilings: Baked white enamel.
2. Aluminum air outlets: Bronze anodized.
3. Mechanical, plumbing, and fire protection equipment.

H. Paint inside of air outlets and duct visible behind air outlets flat black.

3.13 cutting and patching

A. Cut completed construction Work only where sleeves, openings, chases, etc., were inadvertently omitted and only with specific permission of the Architect. In no case shall reinforcing steel be cut without specific permission of Architect.

B. Provide sleeves, caps, plates, escutcheons, flashing, etc., required to fill or close the openings. Provide final grouting, concrete, asphalt, masonry, painting and other materials as required. Make repairs in like and kind for exact patching or surfaces and finishes.

C. Where cutting and patching occurs in streets, sidewalks, alleys and the like, cooperate fully with Owner and municipal or other government bodies.

D. Assume responsibility for damage to any part of premises or work of other Divisions cause by leaks or breaks in piping or equipment furnished or installed under this division during construction and warranty/guarantees period.

E. Core drill existing floors and walls as required for installation. Verify location of all core drills with Architect prior to execution.

3.14 operation by owner

A. Owner may require operation of parts or all of respective installations prior to final acceptance. Cost of utilities for such operation shall be paid by Owner.

B. Operation of installation shall not be construed as acceptance of Work.

3.15 tests and adjustments

A. Labor, materials, instruments and power required for testing provided under respective Sections for Work under that Section.

B. Perform tests to satisfaction of Architect and regulating authority having jurisdiction. Submit to Architect written certificates that tests have been performed in accordance with Specification requirements.

C. Pressure test piping before connection to equipment. No piping equipment or accessories shall be subjected to pressures exceeding their rating.

D. Repair or replace defective Work and repeat tests until particular systems and component parts thereof, receive approval of Architect and regulating authority. Any damages resulting from tests shall be repaired and damaged material replaced, all to satisfaction of Architect and at no cost to Owner.

E. Test equipment and systems which normally operate during certain seasons of year during the appropriate season. Perform tests on individual equipment, systems and their controls. Whenever the equipment or system under test is inter-related with, and depends upon the operation of other equipment or systems and their controls for proper operation, functioning, and performance, the latter shall be operating simultaneously with equipment or system being tested.

F. No piping shall be closed up, furred in, or covered before testing.

1. Notify regulating authority and Architect three days before tests are conducted.

G. Test all systems as specified under various applicable Section. Duration of tests shall be determined by the authority having jurisdiction and in no case less than the time specified.

H. Drain water used for testing from the system after tests are complete. Repair or replace any damages caused by freezing of water left in system at no expense to the Owner.

I. Testing and balancing of air and hydronic systems specified under other appropriate Sections.

J. Preliminary Operation:

1. Operate any portion of installation for Owner's convenience if so requested by Architect. Such operation does not constitute acceptance of Work as complete. Cost of utilities, such as gas and electrical power, will be borne by Owner if operation is requested by Owner.

K. Startup Service:

1. Prior to startup, ensure that systems are ready, including checking the following: proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves.
2. Start and operate all systems. Provide services of factory trained technicians for startup of major equipment and systems including boilers, fire pumps, etc.

L. Adjusting:

1. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.

2. Thereafter, as a result of system operation or as directed by Architect, make readjustments as necessary to refine performance and to effect complete system "tune-up".
3. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions for 72 hours continuously and show specified performance. If, in the opinion of the Architect, performance of equipment or systems is not in accordance with specifications or submitted data, alter or replace equipment at no increase in Contract Sum. Contractor, at his option, may order tests from an independent approved laboratory to prove compliance. All such tests shall be at no increase in Contract Sum. Repeat process as often as required.
4. At completion of Work, provide written certification that all systems are functioning properly without defects.

M. Noise:

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances.
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no increase in Contract Sum. Includes refinish walls, floors etc.

3.16 lubrication

A. Extend grease fittings on all bearings to points of ready and easy accessibility.

B. Lubricate, as required, all motor and fan bearings, etc., before operation of any equipment.

C. Provide a final lubrication to all equipment requiring same immediately before turning over to Owner.

3.17 emergency repairs

A. Provide the Owner with a contact name and telephone number for emergency repairs.

3.18 cleaning

A. The Work of each Section includes removing tools, scaffolding, surplus materials, barricades, temporary walks, debris and rubbish from the Project promptly upon completion of that portion of the Work. Leave the area of operations completely clean and free of these items.

B. During the course of construction, cap all ducts, pipe and electrical conduit daily. Completely cover motors, plumbing fixtures and other equipment in approved manner to ensure adequate protection against entrance of foreign substances.

C. Disconnect, clean and reconnect, whenever necessary, to located and remove obstructions from any system. Repair or replace any Work damaged in the course of removing said obstructions at no additional cost to the Owner.

D. Clean ductwork thoroughly inside and out before grilles, terminal boxes and duct coils are installed and fans operated.

3.19 Waterproof Construction

A. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashings at exterior wall and roof penetrations. Caulk watertight penetrations of foundation walls and floors. Provide membrane clamps at penetrations of waterproof membranes.

B. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rain water. This requirement applies to damper operators and bearing, damper motors, controls, and instruments. See other paragraphs in this Division for application of this requirement to motors, drive, ducts, and fans.

3.20 instructions for owner's personnel

A. Prior to acceptance of Work and during time designated by Architect, provide necessary qualified personnel to operate each system for period of two consecutive full working days.

B. During operating period, fully instruct Owner's Representative in complete operation, adjustment and maintenance of each respective installation.

END OF SECTION 230500

SECTION 230503 – MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for remodeling and modifying existing mechanical equipment.
2. Disposition of existing materials and equipment.
3. Examination of existing conditions.
4. Existing air flow verifications.

1.2 SUBMITTALS

A. Requests for service interruption to HVAC, water supply, drainage, natural gas, etc.

B. Submit shop drawings and equipment data in accordance with Section 013300.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and equipment for patching and extending work: As specified in individual sections.

2.2 GENERAL REQUIREMENTS

A. Obtain written approval from the Owner prior to interrupting services. All interruptions shall be planned shutdowns.

B. The Owner will be occupying the existing building during construction. Provide any temporary connections necessary to maintain service to the existing installations.

C. Work which involves a service outage to occupied area shall be performed on an overtime basis and be included in the project Bid and Scope of Work. Work shall continue until service is restored.

D. Coordinate all removal work to maintain services to all equipment and area until such time as these items are removed or demolished.

2.3 MECHANICAL INSTALLATION REMOVAL AND MODIFICATIONS

A. Abandoned: Remove all piping, ductwork and wiring back to its point of isolation or as otherwise indicated or required. Remove abandoned supports and fixings unless concealed in concrete or masonry construction. Remove all abandoned mechanical equipment.

B. Remaining Piping - Ductwork, Wiring and Equipment: Reinstall existing mechanical installations disturbed or relocated. Certain existing mechanical installations may be located in walls, ceilings or floors that are to be removed and are essential for the operation of other remaining installations. Where this condition occurs provide new extensions to retain service continuity. Installations shall be concealed in finished areas.

C. Equipment Reuse:

1. Assume that all existing equipment and fittings indicated to be reused are in good working condition and can be installed without repairs. Items found to be in need of repair or in unusable condition, shall require notification of the Architect or Owner for direction or decision. Any damage to equipment caused in removal or handling shall be corrected under this contract.
2. Fittings and other equipment removed and to be reused shall be cleaned and refurbished before reinstallation.

D. Extended Systems: All extending piping, and ducting to existing installations shall be balanced as indicated. Air and water balancing shall be performed to maintain existing air flow and water flow rates and room pressurization to areas not affected while maintaining revised design flows to new or remodeled areas. Refer to Section 230593 for additional requirements.

PART 3 - EXECTION

3.1 EXAMINATION

A. Verify field measurements and service arrangements are as shown on Drawings.

B. Verify that abandoned services and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 DISPOSTION OF EXISTING MATERIAL AND EQUIPMENT

A. All material and equipment which is noted or required by the Owner to be salvaged and which is not scheduled to be reused or relocated shall be carefully removed and shall be delivered to the Owner and stored where directed on the site.

B. Carefully remove and store on the site all material and equipment noted or specified to be reused or relocated. Thoroughly clean this equipment prior to installation.

C. Remove all other materials or debris resulting from demolition operations from the site.

3.3 PREPARATION

A. Remove mechanical systems in walls, floors, and ceilings scheduled work under provisions of Section 024119 and this Section.

B. Coordinate utility service outages with the Owner.

3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Section 024119 and this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Disconnect and remove abandoned mechanical services. Remove brackets, hangers, and other accessories.

D. Disconnect and store existing equipment tot be relocated. Replace equipment if damaged, non-functional or does not meet specified capacity.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing mechanical installations which remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.

3.5 DISPOSITION OF HAZARDOUS MATERIALS

A. Dispose of all identified hazardous materials in accordance with applicable regulations and requirements.

3.6 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.7 INSTALLATION

A. Install relocate materials and equipment.

B. Check existing, modified or relocated systems to ensure satisfactory operation. Test and balance, repair or replace systems as necessary.

END OF SECTION 230503

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single Phase Electric Motors.

B. Three Phase Electric Motors.

C. Variable Speed Drives.

1.2 RELATED WORK

A. Section 236423 - Scroll Water Chiller.

B. Section 238219 - Fan Coils.

C. Section 262913 - Enclosed Motor Controllers: Electrical Characteristics.

1.3 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

D. ANSI/NEMA MG 1 - Motors and Generators.

E. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 013300 – Submittal Procedures and Section 230500 – Basic HVAC Requirements.

B. Submit tests verifying nominal efficiency and power factor for motors larger than 20 horsepower.

PART 2 - PRODUCTS

2.1 MOTORS

A. General Electric, Westinghouse, Century or Reliance, UL listed and conforming to NEMA standards, MG-1.

B. 3/4 HP and larger: NEMA rated at 480 volts (unless scheduled otherwise), 3-phase, 60-cycle, low starting torque, squirrel cage induction type; unless indicated otherwise. Coordinate all voltages with Division 26.

C. 1/2 HP and less: NEMA rated at 115-volt, single-phase, 60-cycle, with built-in thermal overload; unless indicated otherwise.

D. Motors 50 HP and over: Reduced voltage start, suitable for star-delta starting.

E. Limit maximum motor speeds to 1750 rpm, unless otherwise specified.

F. Provide totally enclosed, fan cooled (TEFC) motors outside the building or otherwise exposed to the weather, in mechanical room, cooling coil airstream, or suitably protect per NEMA Standards. Provide open drip-proof motors generally inside the building, except where splash-proof or explosion-proof construction is required.

G. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for regreasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.

H. For motors used in conjunction with Variable Frequency Drives, provide motors compatible with drive unit. Additionally, any motor controlled by a variable frequency drive shall incorporate a design to prevent arcing through the motor bearings: Insulated bearings, grounded motor shafts or add-on devices such as those manufactured by Shaft Grounding Systems.

I. Provide multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

J. Efficiency and Power Factor:

1. Requirements apply to all motors, 1 HP and larger, except for following:

   a. Hermetic and semi-hermetic refrigeration compressors.
   b. Fire pumps.
   c. Jockey fire pumps.
   d. Sewage ejectors and sump pumps.
   e. Equipment that operates in emergency only.

2. Ratings in accordance with IEEE, Test Procedure 112A, Method B. Motors labeled with NEMA Efficiency Index code letters.

3. Minimum guaranteed premium efficiencies and power factors at motor full load rating for 1,750 RPM motors.

K. Motor efficiencies are to comply with LEED®No. 2.2 requirements and ASHRAE 90.1.

HP	% Efficiency	% Power Factor
1	82.5	84
1-1/2	84	85.7
2	84	85.7
3	87.5	86
5	87.5	86
7-1/2	90.2	82
10	90.2	85.5
15	91	84.5
20	91.7	86
25	92.4	84
30	92.4	88.5
40	93	83
50	93.6	85.5
60	94.1	88
75	94.5	88
100	94.5	83.8
125	94.5	86
150	95	86
200	95.4	86

L. Motors with other than 1,750 RPM shall be same type motor as would meet requirements for 1,750 RPM motors.

M. Verify voltage and frequency of all motors with Division 26.

2.2 BELT DRIVES

A. Browning, Gates, Woods or Dayton, V-belt drives, with cast-iron sheaves rated not less than 1-1/2 times motor HP.

B. Adjustable motor sheaves for 7-1/2 HP and smaller; solid sheaves for others.

C. Fan static pressures and RPMs indicated on Drawings are only approximate. Adjust or change drives as required to achieve indicated air quantities.

2.3 DRIVE GUARDS

A. Comply with requirements of State Division of Industrial Safety.

B. Provide holes in belt guards for tachometer readings.

C. Indoor Belt Drives: 16 gauge expanded metal or wire screen enclosure with 70 percent free area and steel frame.

D. Outdoor Belt Drives: 16 gauge solid galvanized sheet metal with stamped louvers near top and bottom for ventilation.

2.4 MOTOR STARTERS

A. Manufacturers:

1. Westinghouse
2. Square D
3. General Electric

B. Manual Motor Starters:

1. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, single pole, full voltage controller for fractional horsepower induction motors, with thermal overload unit, red running pilot light, NO auxiliary contact and toggle operator.
2. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated single pole, full voltage controller for fractional horsepower induction motors, without thermal overload unit, red pilot light, NO auxiliary contact and toggle operator.
3. Enclosure: NEMA ICS 6; Type 1, unless otherwise indicated on the Drawings. NEMA 3R in mechanical rooms and outdoors.
4. Size starter per applicable NEMA standards.

C. Magnetic Motor Starter:

1. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower. Solenoid-operated type. Chatterproof armatures.
2. Full Voltage Starting: Non-reversing type.
3. Reduced Voltage Starting: Open-circuit transition wye-delta type.
4. Two-Speed Starting: Compatible with two-speed motor. Include integral time delay transition between FAST and SLOW speeds. Fully rated for motor, limited duty starters not acceptable.
5. Coil Operating Voltage: 120 volts, 60 Hertz.
6. Size: NEMA ICS 2; size per NEMA standards.
7. Overload Relay: NEMA ICS 2; bimetal type, one for each phase.
8. Enclosure: NEMA ICS 6; Type 1, unless otherwise indicated on the Drawings. NEMA 3R in penthouse and mechanical room.
9. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.
10. Auxiliary Contacts: NEMA ICS 2; two normally open and two normally closed contacts in addition to seal-in contact.
11. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO in front cover.
12. Indicator Lights: NEMA ICS 2; RUN: Red in front cover.
13. Control Power Transformers: 120 volt secondary, 50 VA minimum, in each motor starter.

14. Provide terminal strips for external control including Fire Department Control Panel, smoke detector, fire alarm, temperature control wiring, and interlock wiring as required and as shown and required.

2.5 VARIABLE FREQUENCY DRIVES FOR PUMPS AND FANS

A. General:

1. Manufacturers: Graham, Toshiba, ABB.
2. Provide Variable Frequency Drives, referred to as VFDs or VSDs, in the number and voltages shown on the documents. Continuous fan, blower or pump duty. All drive assemblies to be ETL or UL listed. Drives shall meet or exceed applicable NEMA standards. Contacts to be sized per NEMA standards.
3. Factory test complete VFD to ANSI/UL Standard 508. Functionally test options, operate dynamometer at full load, cycle load and speed during factory test.
4. Provide drive with nominal full load amp rating meeting or exceeding motor full load amps. Drive nominal horsepower to equal or exceed motor horsepower.
5. It is the intent of this specification to describe the performance requirements of the VFD. Specification represents minimal requirements for equipment to accomplish these functions.
6. Provide VFD compatible with motor it serves. Coordinate with motor manufacturer.
7. Submit compliance with utility company rebate qualifying requirements.
8. VFD shall have the ability to interface with the building management system.

B. Hardware:

1. Microprocessor based VFD, fully transistorized with 3 phase full wave diode bridge input and Sine-Coded Pulse Width Modulated output.
2. To minimize electrical and acoustical noise and to eliminate low speed cogging, generate 12 kHz carrier frequency at all frequencies. No sudden frequency shifts and associated acoustical noise shifts through the range of 1.5-60 Hz.
3. Input power factors fundamental component of 0.95 or better over entire operating speed range. Efficiency 96 percent minimum from 0-100 percent load. Provide manufacturers test results to verify efficiency and power factor of fundamental components.
4. Standard Solid State Ground Fault Protection. Provide adaptive electronic motor overload protection to protect both the motor and drive at all frequencies. VFD sense load and speed and re calibrate the thermal trip curve to insure low speed motor protection. Initial trip point adjustable from at least 40-100 percent of the VFD amperage rating. Electronic thermal overload circuits which properly protect the motor only at full speed not acceptable.
5. Provide isolated control inputs. Motor speed directly proportional to 0-10V, 4-20 mA and variable resistance signals. Optional 3-15 psi input available for pneumatic control.
6. Microprocessor based control board common for all sizes from 1-350 horsepower.
7. Switch selectable drive operation options. Include at minimum the following functions:

    a. Automatic minimum speed holding if control signal is lost.
    b. Automatic reduction in voltage with a reduction of load.

c. Two step over frequency adjustments.

8. Motor direction reversing.
9. Provide the following operational features:

   a. Speed search transfer. Able to start from bypass fault trip into spinning load without stopping the motor or creating fault condition. Match motor speed and then drive motor to proper speed.
   b. Adjustable current limit threshold.
   c. Multiple restart upon fault trip.
   d. Minimum 10: 1 down ratio.
   e. Individually adjustable acceleration and decelerating patterns, adjustable from 1-1800 seconds.
   f. Minimum 0.2 second power loss ride through without drive trip or loss of programming.
   g. Suitable for installation and use under the following environmental conditions: -10 to 40 degrees C (20 degrees F to 104 degrees F), 0-90 percent RH, non-condensing. Do not locate in direct sunlight or forced air circulation.
   h. Total harmonic distortion limit 10 percent.
   i. Individually programmable maximum motor speeds in auto and manual modes.

10. Provide isolation transformer.
11. LCD digital display, using full English and Spanish words. Alphanumeric codes not acceptable. LED displays not acceptable.
12. All VFDs to have the same display, keypad and connectors, regardless of horsepower.

C. Fault Indication and Operation:

1. The following fault conditions cause the VFD to shut off (trip). Indicate with complete words on display. VFD to be capable of fault self-diagnosis. The last three faults shall be stored in memory and shall be capable of being displayed.

   a. Phase loss.
   b. OC Instantaneous Overcurrent.
   c. OV Overvoltage.
   d. UV Undervoltage.
   e. OH Over Heat.
   f. EB External Failure.
   g. Ground fault.
   h. Pilot "red running" light, pilot power "green" light.

2. VFD attempt to restart minimum five times, with ten second pause between attempts, after tripping on fault. Dry contact on VFD close after fifth unsuccessful restart attempt.
3. Limit power line noise to voltage distortion factory and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power converters. Maximum voltage distortion 5 percent.
4. Do not emit radiated RFI in excess of limitations in FCC Rules and Regulations, Part 15, for Class A computing devices. Carry FCC compliance label. Provide RFI filters on each PWMS drive.

D. Enclosure, Control Module and Bypass Modes:

1. VFD and all bypass components housed in single NEMA enclosure.

   a. NEMA Type 1: Inside the building.
   b. NEMA Type 3R: Exposed to weather.

2. Equip with solid state input fuses of the I2R type.
3. Equip with fusible door interlocked disconnect switch. Switch load break and horsepower rated and listed.
4. Equip with digital operator interface with following functions:

   a. Percent frequency indication on LCD display.
   b. Fault indication on the LCD display. Fault reset.
   c. Hand/off/auto operation switch.
   d. Digital speed control.
   e. Forward/reverse operation.

5. NEMA 3R weatherproof enclosures: As above and complete with inlet fans, inlet and outlet filters, and louvers, along with NEMA 4 operator's devices. Indicator lamps (power on, drive, bypass, safety) shall be bright LEDs, or equivalent conventional lamps, that are easy to tell if they are on or off in bright sunlight conditions to the naked eye without shielding. Enclosures to have hinged windows complete with locks, so that operators can read drive displays and operate drive keypad. The hinged window shall not be positioned to allow access to uninsulated electrical components at line voltage. HOA switch and speed potentiometer shall be accessible either through the hinged window or on the exterior of the door.
6. Equip with three Automatic Transfer Contactors which fully isolates the VFD from line and load side in bypass mode. Contactors mechanically and electrically interlocked. Contactors respond automatically to VFD failure or to dry contact from external source. Contactors load break and horsepower rated. When in Bypass mode, the totally de-energized VFD. Unacceptable if VFD power input or output bus is energized when VFD is in Bypass mode. Furnish Hand/Off/Auto switch on the face of the VFD enclosure, control transformer, disconnect switch and service switch.
7. Provide auxiliary contacts for external controls input. Contact from fire alarm control system overrides other controls.
8. UL label entire assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Electrical work under this Division shall conform to all requirements of Division 26 – Electrical.

3.2 START-UP SERVICE

A. Provide start-up commissioning of variable frequency drive and optional circuits by factory certified service technician experienced in start-up and repair services. Commissioning personnel same personnel that will provide factory service and warranty repairs at site. Sales personnel and other agents who are not factory certified technicians for drive field repair not acceptable.

B. Include checking for verification of proper operation and installation and interface wiring to building automation system. Include as a minimum:

1. Verify contractor wire terminations to VFD optional circuitry.
2. Verify proper operation and reliability of VFD, motor being driven and building automation system.
3. Provide up to one hour of Owner/operator training on operation and service diagnostics during commissioning.
4. Measure to verify proper operation on:

a. Motor voltage and frequency. Verify proper motor operation.
b. Control input for proper building automation system interface and control calibration.
c. Calibration check for:

1) Minimum speed.
2) Maximum speed.
3) Acceleration and deceleration rates.

d. Adjust as necessary.

3.3 WARRANTY

A. Provide unconditional warranty for 36 months from date of installation in format specified in Division 01 – General Requirements. Include parts, labor, travel costs and living expenses incurred by manufacturer to provide factory authorized on-site service.

END OF SECTION 230513

SECTION 230516 – EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion Loops
2. Seismic Expansion Compensators
3. Pipe Anchoring and Guides

1.2 PERFORMANCE REQUIREMENTS

A. Provide seismic expansion compensator capable of elongating and compressing.

B. Base expansion on 50 degrees F installation temperature and up to 1.3 times maximum operating temperature.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Seismic Expansion Compensators

1. Metraf Flex
2. Hyspan
3. Flexonics

B. Expansion Loops:

1. Contractor is responsible for the design of a system allowing for expansion of piping.
2. Contractor to design and coordinate loop or other acceptable alternative.

C. Cryogen vent pipe expansion joint

1. Hyspan.
2. Or equal.

2.2 SEISMIC EXPANSION COMPENSATORS

A. Compensators for Water Piping 3 inches and Larger: Hyspan Series 1500 Universal with flanged ends, tie rods, and 321 stainless steel laminated bellows.

B. Compensators for Steam and Condensate Return Piping 3 inches and Larger: The same as for water piping except with an internal flow liner.

C. Compensators for Piping 2-1/2 inches and Smaller: Hyspan 321 stainless steel braided hose. Provide Series 4505 with threaded ends for steam, condensate return, and natural gas; Series 4510 with sweat ends for domestic cold, hot, and hot water return; Series 4510 with sweat ends cleaned and capped for oxygen service per CGA pamphlet G-4.1 for medical oxygen, vacuum, and compressed air.

D. Provide units suitable for minimum 150 psi at 400 degrees F.

E. Units shall be manufactured and installed in accordance with EJMA recommendations and shall provide for multiple plane movement for seismic isolation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide pipe alignment guides in lines having pipe expansion loops.

B. Provide at least 2 set of guides immediately adjoining each side of each expansion loop.

C. Size guide cylinder to allow the full insulation thickness to be carried through the guide with ample clearance and without restricting the free movement of the pipe.

D. Size guide cylinder for sufficient length to contain the total movement of the spider.

E. Provide expansion loops as required.

F. For steam and condensate return, provide minimum of 3 elbow offsets on branch pipe connections into mains and at each riser takeoff to allow piping flexibility and expansion.

G. Provide seismic expansion compensators where piping crosses new construction seismic and expansion joints and where piping crosses separations between new and existing construction.

H. Provide flexible duct connections at the same points of crossover specified for piping. Refer to Section 233300 – Air Duct Accessories.

I. Provide bellows type expansion joint for cryogen vent pipe as shown on drawing. Expansion joint to be rated for 35 PSI and -45 degF.

END OF SECTION 230516

SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide piping specialties as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Section 232113 - Hydronic Piping.

B. Section 230523 - General Duty Valves for HVAC Piping.

C. Section 232213 23 - Steam and Steam Condensate Piping.

1.3 SUBMITTALS

A. Product Data: Refer to Section 013300 for procedure.

PART 2 - PRODUCTS

2.1 STEAM-TYPE THERMOMETERS

A. 9-inch scale adjustable angle, 2 degrees F scale division, red appearing mercury, lens front tube, cast aluminum case, brass separable socket or flange with perforated stem, and 2-1/2 inch extension necks on insulated piping.

B. Thermometers shall be installed as shown on the Drawings. Thermometer wells only shall be installed in like manner. All thermometer wells shall be constructed of brass or stainless steel and where installed in insulated piping shall have at least 2-1/2 inch lagging extension. Pressure temperature ratings of each well shall be suitable for the system in which it is installed. All wells shall be filled with silicon and be complete with caps and chains. Thermometers and thermometer wells shall have the following insertion lengths:

C. Located in Horizontal Piping and Vertical Piping below 6 feet - 0 inches:

1. 4-inch and 5-inch Pipe: 2-1/2 inches.
2. 6-inch and 8-inch Pipe: 5 inches.

D. Locate in Vertical Piping above 6 feet - 0 inches:

1. 3-inch, 4-inch and 6-inch Pipe: 5 inches.
2. 8–inch and 10-inch Pipe: 8 inches.

2.2 PRESSURE GAUGES

A. Weksler, Ashcroft, Trevice, Marsh, 4-1/2 inch dial, with cast aluminum case, one percent accuracy, with calibration adjustment, for direct pipe mounting. Provide flanged case type for board mounting. White dial, black scale.

2.3 TEST PLUG

A. Peterson Engineering Company, Pete's Plug, No. 110/100XL with yellow cap, brass body and Nordel valve core, suitable for 500 psig and 275 degrees F for water systems. Locate where required for balancing and where indicated on Drawings. Coordinate with balancing firm.

2.4 PRESSURE GAUGE TAPS

A. Provide brass needle or gate valve.

2.5 FLANGES

A. NIBCO or SYSPAC, convoluted, carbon steel, cold-formed weld-neck and blind flanges in conformance with the design criteria of Section VIII, Division I of the ASME Pressure Valve Code, may be used. Flanges drilled and tapped to match ANSI 150. All material to comply with requirements of ASTM A 516. Gaskets teflon or as recommended by the flange manufacturer and suitable for the service involved. Slip-on flanges will not be permitted. 150-pound and 300-pound weld-neck and screwed steel flanges on steel lines to conform to ANSI Standard B16.5 for dimensions and ASTM A 181 Material Standard.

2.6 FLOW METERS

A. Provide flow meters with calibrated venturi orifice plate or inclined tube manometer and flanges and taps. Provide charts for conversion of pressure readings to gpm and meter gauge in a case.

B. Meter device shall be annular primary element flow stations with portable meter set supplied by 1 manufacturer. Measuring station shall be stainless steel complete with safety shutoff valves and quick coupling connections and a permanent metal tag showing designed flow rates, meter readings for designed flow rates, metered fluid, line size and tag, station or location number. Stations shall be either nipple section or weld insert type and be rated to 275 psi at 400 degrees F. Sensing element shall be able to be rotated. Accuracy of the flow measuring elements shall be 2.0 percent and .2 percent repeatability as verified by independent laboratory reports. Metering kit shall include 2 bleed valves, master chart for direct conversion of meter readings to gpm, rustproof carrying case, two 10 foot long rubber test hoses with brass valves for quick connections to the measuring stations.

2.7 BALANCING DEVICES

A. Bell & Gossett, Model CB circuit setter, Taco, Armstrong, 1/2-inch through 3 inches, bronze balancing valve calibrated and with provisions for quick connection to portable differential pressure meter; with integral degree of valve opening indicator; 125 psig working pressure at 250 degrees F.

B. Provide on Model R0-2 differential pressure meter suitable for quick connection to balancing devices and with differential pressure versus GPM curves for each device size.

C. For pipe 4 inches and larger, provide Bell & Gossett Model OP circuit sensor.

2.8 AUTOMATIC WATER FEEDERS, LOW WATER CUTOFFS, PUMP CONTROLLERS, FLOW SWITCHES AND FLOAT OPERATED VALVES AND SWITCHES

A. McDonnell-Miller, Transamerica or Gems.

2.9 AUTOMATIC FLOW LIMITER VALVES

A. Griswold only known complying manufacturer. Combination valves with two union ends, interchangeable inlet and outlet, handle ball valve, dual 1/4-inch NPT pressure and temperature test valve, AISI type 300 passivated stainless steel control cartridge, AISI 17-7 PH stainless steel coil spring, 5 percent of rated flow, ethylene/propylene seals, removable cartridge.

B. Sizes 1/2-inches through 1-1/4 inches: Brass alloy body, ASTM B584, minimum 150 psig/250 degree F, 20 mesh integral removable stainless steel strainer, even if Y-strainer shown on inlet to coil.

C. Sizes 1-1/2 inches through 2 inches: Gray iron body, ASTM-A-126-61T, Class 30, minimum 300 psi 275 degrees F, class flanges, iron ASTM-A126-61T butterfly valves. Provide Y-strainer with blowdown valve on inlet to coil whether shown or not.

D. Sizes 2-1/2 inches and Larger: Flanged, gray iron body, ASTM-A-126-61T, Class 30, ANSI B16.5 150 psi class flanges, iron ASTM-A126-61T butterfly valves. Provide Y-strainer with blowdown valve on inlet to coil whether shown or not.

E. Note: Shutoff valve(s) may be omitted if already included in pipe assembly.

F. Provide one No. 3429B pressure/temperature dual hose meter kit with 4-1/2 inch -14.7 to 150 psi diameter gauge, 3-way push button valve, 5 feet long dual connection hoses, dual shutoff valves, flow conversion chart, carrying case.

G. "Ultra-Z" with integral inlet and outlet unions, handle ball valve, Y-strainer, two pressure/temperature plugs, removable cartridge acceptable on terminal box coils, where flows and pressures permit. Install "Ultra-Z" on supply inlet to coil.

H. Submit certified independent laboratory accuracy tests.

I. Five year warranty.

2.10 DIELECTRIC UNIONS OR FLANGES

A. EPCO, Superstrut 715 or 716.

2.11 STRAINERS

A. C.M. Bailey No. 100A, Mueller or Red-White 380B (bronze) or 381 (cast iron). Provide Hubbell or Refrigerant Specialties on refrigeration system. Provide Type 316 stainless steel metal screen with 0.045 inch perforations for steam.

B. Bottom shouldered with gasket, inserted bronze cap with tap for blowdown, removable screen.

C. 2 Inches and Smaller: 250 pounds, threaded 20-mesh Monel screen.

D. 2-1/2 Inches to 4 Inches: 150 pounds and 250 pounds, flanged, 3/64-inch perforated brass screen.

E. 5 Inches and Larger: 150 pounds and 250 pounds, flanged, 1/8-inch perforated brass screen.

F. Basket Type: Hoffman, Sarco, Armstrong. Simplex or duplex as noted or required. Cast iron or fabricated carbon steel, with bolted bonnet cover and perforated elements. Elements--Type 304 stainless steel or Monel metal screens. 2 inch – 3 inch size with 3/64 inch perforations, 4-inch and larger sizes with 1/8 inch perforations for liquid, 0.045-inch for steam. Provide with backup strainers. At least 6 times pipe cross-sectional area. 150 psig working pressure.

2.12 SAND SEPARATORS

A. Griswold No. 3CS or Lakos.

B. Remove solids 50 microns/325 mesh in size and heavier than 1.20 specific gravity. Provide 5-pipe diameter straight inlet and outlet piping.

C. 150 psig working pressure, 10 gauge carbon steel. Open chamber inlet with or without slots. Hydrostatically test. Seismic legs.

D. Five-year warranty. ASME certified.

E. Automatic purge controller, purge duration 4 second minimum to 36 second maximum. Cycle time ½-hour minimum to 36 hours maximum. Set for minimum purge and 24-hour cycle time and adjust as needed. 16 GA steel CAD plated and painted cabinet, 16 GA aluminum anodized panel. 120 VAC, 1 Amp, 55 VA input, 24 VAC, 1 Amp output. Key lock.

F. Solenoid purge valve 1 inch size (7 gallon in 10 seconds) for chilled water, unless noted otherwise. (1½ inches = 17 gallons in 10 seconds, 2 inches = 37 gallons in 10 seconds.) Straight/angle, 200 psi, -40 degrees F to 180 degrees F, 24 VAC, stainless steel solenoid in solid epoxy resin, U.L. listed, CSA and FM approved. Body: ASA cast iron ASTM A-48. Trim: Marine bronze ASTM B-62 and stainless steel AISI 303. Bolts: 316 stainless steel. Disk: Buna N. Diaphragm: Synthetic rubber nylon reinforced. Cover: ASA cast iron ASTM A-48.

2.13 FILTER-FEEDER TANK

A. Griswold, Wingert, Neptune.

B. 200 pig at 212 degrees F, 10 gauge carbon steel tank, 9 gauge heads, removable cast iron cap with Buna N ring, seismic support legs, interior and exterior epoxy coated, air release valve and pressure gauge.

C. 25 micron cleanable polyester bag filter in a removable stainless steel basket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermometers and gauges for easy readability (height, distance, view angle) from floor, except thermometers and gauges at ceiling coils.

1. Use remote mounted dial thermometers when mercury thermometers are not easily readable due to distance or position in piping.
2. Install gauges on non-vibrating backing. Install related gauges (e.g. pump suction, discharge) on common supports and at same height.
3. Provide instrument cocks at pressure gauges.

3.2 APPLICATION

A. Provide Pete's Plug pressure/temperature test plugs at suction and discharge of all pumps, inlets and outlets of boiler, coils, pressure reducing valves, heat exchangers, riser take-offs, etc. Provide two sets of pressure gauges and thermometers.

B. Provide thermometer at inlet and outlet of each converter and air handling unit coil and condensate return units.

C. Provide duct pressure gauge in each fan discharge duct and access each filter bank.

D. Provide duct thermometer in each air handling unit fan discharge duct and each return air inlet duct.

E. Provide pressure gauges on inlet and outlet of all pumps.

3.3 TESTING

A. Test thermometers, pressure gauges and water meters for accurate indication with known calibrated master; automatic water feeders, steam traps, air vents, trap primers, and vacuum breakers for proper performance.

B. Test air vent points to insure all air has been vented.

C. Test other piping specialties for proper operation.

END OF SECTION 230519

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install all valves as indicated on the Drawings and as specified.

B. For steam system valves, refer to Section 232213 23 Steam and Steam Condensate Piping.

1.2 RELATED WORK

A. Section 230500 - Basic HVAC Requirements.

B. Section 230529 - HVAC Piping Supports, Guides, Hangers and Anchors.

C. Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 232113 – Hydronic Piping.

E. Section 232213 23 - Steam and Steam Condensate Piping.

F. Section 232216 - Steam and Steam Condensate Specialties.

1.3 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit under provisions of General Conditions, Division 01, Section 013300 Submittal Procedures, Section 016000 Product Requirements and Section 012500 Substitution Procedures as applicable.
2. Furnish shop drawings, product data and samples for valves.
3. Refer to Section 230500 Basic HVAC Requirements for startup requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Crane, Milwaukee, Nibco, Stockham, Jenkins, Bell & Gossett. Provide valves of same manufacturer for all Mechanical Sections, where manufactured, including valves furnished with equipment. Steam valves per Section 232213 23 Steam and Steam Condensate Piping, not provided under this section.

B. For copper tubing, provide solder-joint valves, or IPS-to-Copper adaptor, sized for use with tubing and respective valve.

C. For flanged valves, provide companion flanges of same PSI rating-class of valve being used.

D. Provide valves rated not less than 125-pound steam working pressure/200-pound WOG for plumbing systems, and 150-pound SWP/300-pound WOG for mechanical and fire protection. Provide higher pressure valves where indicated.

E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of globes valves, plug cocks, ball valves, etc.

F. Provide valves as specified in valve schedule below. Figure numbers listed are given as standard for type and construction.

G. Provide composition discs for bronze globes, angles or checks. Provide bronze discs for IBBM globes, angles, or checks except where otherwise specified or approved at recommendation of the manufacturer.

H. Wheel handles to be non-heating style cast from malleable iron ASTM A197.

I. Mark each valve at the factory with the following minimum information, engraved, stamped or cast on each valve or metal tag permanently attached to the valve.

1. Manufacturer's name.
2. Catalog or Figure number.
3. Size and pressure class.
4. Arrows shall indicate direction of flow on check, globe, angle, non-return and eccentric plug valves.
5. UL approved valves and shall bear the UL label.

J. Valves for special systems including medical gases.

K. Provide union ends or flanged connections on all valves with Teflon components, or components with temperature sensitivity.

2.2 BUTTERFLY VALVES

A. For shutoff and balancing up to 150 pounds per square inch (psi) and 212 degrees F. Balancing valves must include integral memory stop.

B. Butterfly valves may be used in lieu of gate valves, and lubricated plug valves where service permits on all piping 2-1/2 inches and larger on heating hot water, chilled water, condenser water, process water, and at other specific locations as indicated on the drawing. Butterfly valves may not be used on steam or steam condensate service.

C. Lug type for line shutoff or balance and for equipment isolation shutoff. Lugs drilled and tapped to match ANSI 150 flanges. Use cap screws both sides.

D. Extended neck for insulation.

E. Valves through 6 Inches: 10-degree lever lock handles or infinite handles with balanced adjustable stops. Lever-lock operations complete with throttling plates, position locks and memory stops.

F. Valves 8 Inches and Larger: Heavy duty weatherproof gear operators with indicator. Lever-lock operations complete with throttling plates, position locks and memory stops.

G. Bodies of Meehanite iron, seats E.P.D.M. for services over 180 degrees F with phenolic reinforcement.

H. Discs Aluminum Bronze. Stems Type 410 stainless steel and of dry design with no exposure to line flow, or fitted with sleeve type bearings if exposed to line flow.

2.3 NONSLAM CHECK VALVES

A. As shown and at all pumps, mount non-slam silent closing check valves on the discharge side of the pumps, except swing check valves at sewage ejectors.

2.4 SAFETY AND RELIEF VALVES

A. Consolidated or Kunkle, type and size as applicable, constructed and rated in accordance with ASME, and so stamped.

B. Use "pressure relief valves" for unheated liquids.

C. Use "safety relief valves" for heated liquids, including water boilers, etc.

D. Valves suitable and rated for proper temperatures; for "safety relief valves" minimum temperature rating is saturated steam temperature corresponding to pressure 10 percent higher than valve set pressure.

E. Valves shall have set pressure indicated but not more than working pressure of protected equipment.

F. Valves shall open, under test, at set pressure, with tolerance of plus or minus 2 psi for set pressures up to 70 psig, and plus or minus 3 percent for set pressures in excess of 70 psig.

G. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.

H. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings.

2.5 PRESSURE SUSTAINING VALVES

A. General

1. The valve shall maintain in constant upstream pressure by relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.
2. Manufacturers:

    a. Cla-Val 50-01/650-01.
    b. Flow Control Industries.

B. Main Valve

1. The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
2. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be cast or ductile iron.
3. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section, contained by a disc retainer and forming a tight seal against a removable seat insert. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of sturdy design capable of withstanding opening and closing shocks.
4. The diaphragm assembly containing a 304 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and integral bearing in the valve seat. The seat shall be a tapered one-piece design and shall provide a positive, drip-tight shut off. The stem shall be drilled and tapped to receive accessories. The diaphragm assembly shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.
5. The flexible, non-wicking diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer on nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.
6. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6 inches and smaller size valves shall be threaded into the cover and body. Valve seat in 8inches and larger size valves shall be retained by machine screws. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted.
7. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment. Electrical components such as limit switches and actuators shall have a one-year warranty.

8. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4 inch through 24 inch sizes and complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, CV factor, system velocity, and if there will be cavitation damage.

C. Pilot Control System:

1. The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is normally held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.

2.6 VALVE SCHEDULES

A. Model numbers for pressure listed 150 psi SWP/300 psi WOG unless noted otherwise. Provide equal valve for other pressures not specified.

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
1.	GATE VALVES:			
	2 INCHES OR SMALLER	USE BALL VALVE SPECIFIED HEREIN.		
	2-1/2 INCHES AND LARGER: 125-POUND FLANGED IRON BODY, BRONZE MOUNTED, BRONZE STEM, OS&Y, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO F617-0	CRANE NO. 465½	STOCKHAM G-623
	2 INCHES AND SMALLER: 150-POUND BRONZE BODY, SCREWED ENDS, ALL BRONZE UNION BONNET, RISING STEM, TFE IMP. ASBESTOS-FREE PACKING. STEM MATERIAL ASTM B99.	NIBCO T-134	CRANE 431-UB	STOCKHAM NO.B-120

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
	2-1/2 INCHES AND LARGER: 250-POUND FLANGED IRON BODY, BRASS STEM, OS&Y, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO F667-0	CRANE NO. 7½E	STOCKHAM F-667
2.	GLOBE VALVES:			
	2 INCHES AND SMALLER: 125-POUND BRONZE BODY, SCREWED ENDS, RISING STEM, SCREW-IN BONNET, TFE IMP. ASBESTOS-FREE PACKING. STEM MATERIAL TO ASTM B-371.	NIBCO T-211-B	CRANE NO. 1	STOCKHAM B-16
	2-1/2 INCHES AND LARGER: 125-POUND FLANGED IRON BODY BRONZE MOUNTED, BOLTED BONNET, BRONZE RISING STEM, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO F718-B	CRANE NO. 351	STOCKHAM G-512
	2 INCHES AND SMALLER: 150-POUND FLANGED BODY, SCREWED ENDS, RISING STEM, UNION BONNET, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO T-235-Y	CRANE NO. 7-TF	STOCKHAM B-22T

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
	2-1/2 INCHES AND LARGER: 250-POUND FLANGED IRON BODY, BRONZE MOUNTED, BOLTED BONNET, BRONZE RISING STEM, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO F768-B	CRANE NO. 21-E	STOCKHAM F-532
3.	GLOBE VALVES FOR FIRE PROTECTION SERVICE:			
	2 INCHES AND SMALLER: 150-POUND FLANGED BODY, SCREWED ENDS, RISING STEM, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO ¼: KTG5 ½ TO 1: KT65UL. 1¼ TO 2: KT211WUL	CRANE NO. 14½P	STOCKHAM B-29
	2½ INCHES AND LARGER: 150-POUND FLANGED IRON BODY, BRONZE-MOUNTED , BRONZE RISING STEM, TFE IMP. ASBESTOS-FREE PACKING.	NIBCO 2½ TO 3: T211WUL. OVER 3": F718-B	CRANE NO. 143	STOCKHAM G-512
4.	LOCKSHIELD VALVES: SAME AS SPECIFIED EXCEPT KEY OPERATED.			
5.	BUTTERFLY VALVES:			

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
	2½ INCHES AND LARGER: IRON BODY LUG OR GROOVED END TYPE, 703S.S. SHAFT-TYPE 316, DUCTILE IRON DISC, BUNA N SEAT-LESS THAN 180°F SERVICE, EPT SEAT 180°F TO 250°F SERVICE	DEMCO NE-LUG	DEZURIK 632L	VICTAULIC 700 704
6.	BALL VALVES:			
	1/4-INCH TO 2 INCHES: 150-POUND SWP/600-POUND WOG BRONZE BODY, SCREWED ENDS, TEFLON SEATS AND SEALS, THREE-PIECE BODY, FULL PORT.	NIBCO T595-Y	CRANE 2330TF	STOCKHAM S-216
	2-1/2 INCHES TO 6 INCHES: 150-POUND STEEL AND IRON BODY, NICKEL OR CHROMIUM PLATED STEEL BALL, STEEL STEM, BUNA-N-SEALS.	DEMCO SERIES V	CRANE 701	WALWORTH 4100F
7.	NEEDLE GLOBE VALVES (INSTRUMENT COCKS):			
	1/8" THROUGH 3/4": BRONZE BODY, 200-POUND STEAM, 400-POUND WOG BRONZE SPINDLE, THREADED CONNECTIONS.	JENKINS 743G	CRANE #88	STOCKHAM B-64
8.	CHECK VALVES:			

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
	2 INCHES AND SMALLER: 125-POUND BRONZE BODY, SCREWED ENDS, SWING TYPE, Y-PATTERN.	NIBCO T-413-Y	CRANE NO. 37	STOCKHAM B-320-T
	2-1/2 INCHES AND LARGER: 125-POUND IRON BODY, BRONZE MOUNTED, FLANGED, SWING TYPE.	NIBCO F918-B	CRANE NO. 373	STOCKHAM G-931
	2 INCHES AND SMALLER: 150-POUND BRONZE BODY, SCREWED ENDS, SWING TYPE, Y-PATTERN.	NIBCO T-433-Y	CRANE NO. 137	STOCKHAM
	2-1/2 INCHES AND LARGER: 150-POUND STEEL BODY BRONZE MOUNTED, FLANGED, SWING TYPE.	NIBCO F938-31	CRANE NO. 39-E	STOCKHAM
9.	SPRING LOADED CHECK VALVES:			
	2 INCHES AND SMALLER: 125-POUND BRONZE BODY, SCREWED ENDS, BRONZE TRIM, S.S. SPRING, IN-LINE TYPE, RESILIENT DISKS.	NIBCO NO. T-480	MUESSCO 203BP	METRAFLEX S701
	2-1/2 INCHES AND LARGER: 125-POUND SEMI-STEEL BODY, FLANGED BRONZE TRIM, S.S. SPRING, GLOBE STYLE.	NIBCO F910-B	MUESSCO 101AP	METRAFLEX 900

	DESCRIPTION	MFG. NO. 1	MFG. NO. 2	MFG. NO. 3
	2-1/2 INCHES AND LARGER: 250-POUND SEMI-STEEL BODY, FLANGED BRONZE TRIM, S.S. SPRING, GLOBE STYLE.	NIBCO F960-B	MUESSCO	METRAFLEX 900
10.	COMBINATION CONTROL-CHECK VALVES MULTI-PURPOSE VALVES:			
	2 INCHES AND LARGER: 175-POUND COMBINATION: SILENT CHECK, BALANCE AND SHUTOFF VALVE, LINE SIZE, IRON BODY, FLANGED, CALIBRATED STEM FOR BALANCE SETTING.	BELL & GOSSETT NO. 3D	MUESSCO NO. 711	
11.	MANUAL AIR VENTS: 125 PSIG, STEAM LEVER HANDLE 1/4-INCH SIZE.	LUKENHEIMER NO. 1177	CRANE	

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all equipment with shutoff valves. Provide all valves, strainers and check valves, except control valves and unless specifically sized, of same size as the pipes in which they are installed unless otherwise indicated. Provide fixture stops.

B. All hand-controlled line valves are to be gate, ball or butterfly valves, except where throttling control or frequent operation is required, provide globe, butterfly or angle valves, unless otherwise shown or specified. Install all globe and angle valves to close against the pressure.

C. Position gate valves so that stems are in any suitable angle from horizontal to upright position. Install valves only in accessible locations. Do not install valves with stems pointing downwards unless specifically indicated.

D. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 7 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor. Provide operating handles for all valves and cocks without integral operators. Provide adequate clearance for easy operation.

E. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified.

F. Wye-type Strainers: Ahead of all automatic valves, pumps, coils, pressure regulating valves and similar devices and as shown in systems that are not fully protected by automatic strainer systems. Basket-type strainers: where shown or required.

G. Install strainers in horizontal position.

H. Provide gate blow-down valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection.

I. Install swing checks and gravity closing lift checks in horizontal position.

J. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger.

1. Water system relief valves: Extend to over approved drain receptacle with airgap.
2. Steam system safety valves: discharge through drip pan elbow. Pipe elbow and pan drains same as water system relief valve. Pipe system vent to above roof as shown on drawings.

K. Provide ball valves to isolate shock absorbers.

L. Provide open-ended line valves with plugs or blind flanges.

M. Provide valves at points shown and as required for complete isolation of equipment, risers, branches off mains, automatic valves and tanks arranged so as to give complete and regulation control of piping systems throughout the building. Install valves, with neat appearance and grouping, so that all parts are easily accessible for maintenance. Not all isolation valves are shown.

3.2 TESTING

A. Test valve bonnets for tightness. Test operate valves from closed-to-open-to-closed position while valve is under test pressure.

B. Test automatic valves including solenoid valves, expansion valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.

C. Insure that valves are field checked for packing and lubricant and that disc is for service intended. Replace leaking packing. Service valves which do not operate smoothly and properly with suitable lubricant before placing in operation.

D. Test relief valves, safety relief valves, safety valves and temperature and pressure relief valves three times.

END OF SECTION 230523

SECTION 230529 – HVAC PIPING SUPPORTS, GUIDES, HANGERS AND ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Pipe, duct, and equipment hangers, supports, and associated anchors.

B. Pipe shields and fire rated sleeves.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks.

E. Contractor is responsible for the design of the support, bracing and anchorage systems for ducts, piping and equipment. These systems shall be designed by a registered California Structural Engineer. Scope includes shaft intermediate structural members of other devices required for complete installation.

1.2 RELATED SECTIONS:

A. Section 230500 - Basic HVAC Requirements

B. Section 230717 - HVAC Piping Insulation

C. Section 230530 - Pipe and Pipe Fittings

D. Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 232213 23 - Steam and Steam Condensate Piping

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Supports for Sprinkler Piping: In conformance with NFPA 13.
2. Supports for Standpipes: In conformance with NFPA 14.

B. Reference Standards:

1. ANSI/ASME B 31.1 - Power Piping.
2. NFPA 13 - Standard for the Installation of Sprinkler Systems.
3. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

C. Suspended piping (medical, mechanical, fire protection) ductwork, and equipment shall be attached to the structure, supported by and seismically braced to meet current CBC requirements.

D. Designed, engineered and built by the system contractor. System contractor to use OSHPD pre-approved methods. These details shall be reviewed and approved by structural engineer before installation.

E. Do not mix seismic bracing designs within a given new system design.

F. Fire protection piping shall be seismically braced, supported and attached to the structure according to 1994 Edition of NFPA 13.

G. All conditions which involve thermal and/or building expansion and contraction shall be taken into consideration and identified in the as-built documents.

H. Seismic bracing, support and anchorage to the structure of all conditions which involve thermal and/or building expansion and contraction shall be engineered and built by the applicable system contractor. Review these details with project structural engineer and mechanical engineer.

I. Contractor shall submit, prior to installation, seismic brace detail(s), seismic brace connection to system details(s), seismic brace connection to structure details(s) and seismic brace spacing or layout details.

J. All data submitted as being pre-approved by OSHPD shall be invalid and unusable unless each individual page is marked with an active, non-expired, dated and signed OSHPD stamp.

K. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase. Do not size connection to the structure according to threaded hanger rod size.

L. Contractor shall submit, prior to installation, data identifying the various support to structure connections and seismic brace structure connections. Submittal data shall identify the following:

1. Location of connections:

    a. Numerical identification of maximum allowable design value of connecting method.
    b. Numerical value of applied load or reaction.
    c. Type of connection (vertical support, vertical support with seismic brace, seismic brace).
    d. Seismic brace reaction type (tension only, tension and compression).
    e. Detailed drawing (listing all related components) of method of connections.
    f. Seismic design force applications greater than those noted on SMACNA shall be engineered by the contractor and submitted prior to installation. These applications shall be reviewed and approved by the project structural engineer.

M. Sustainable Design Quality Assurance: Adhesives, sealants, finishes, paints and coatings used for work in this section, applied on site and installed inside the weatherproofing barrier shall meet the requirements of Section 011010 - Sustainable Design, where applicable and shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

1.4 DESIGN RESPONSIBILITY

A. Design support and anchorage systems in accordance with procedures indicated herein.

B. Contractor is responsible for designing the support and bracing systems for suspended piping, ductwork, conduit and cable trays. Whenever possible, suspended piping, ductwork, conduit and cable trays shall be supported in accordance with the following pre-approved OSHPD systems:

1. OSHPD OPM-004-13 Mason Industries, Inc. Seismic restraint components for suspended utilities.
2. OSHPD OPM-0052-13 B-Line/Tolco Seismic bracing and support systems.

C. Contractor shall submit the items listed below pertaining to the support and bracing of suspended piping, ductwork, conduit and cable trays that are required to be reviewed and accepted by the design team before proceeding. Refer to structural drawings for allowable loads suspended loading from structure.

1. Bracing drawings – plan and details of bracing that will be used on project. Details shall clearly show how systems are connected to the structure and are coordinated with the actual structural systems on the project.
2. Loads on structure – floor plans showing connection locations to structure along with the design forces imposed on the structure. Show that the forces on structure stay within loading criteria provided in documents.
3. Where pre-approved OSPHD system does not cover a specific system, Contractor shall be responsible for providing support details and design calculations.
4. All support plans, details and calculations shall be stamped and signed by a licensed Structural Engineer in the State of California.
5. Contractor is responsible for the design of the support, bracing and anchorage systems for piping and ductwork supported on roof. These systems shall be designed and stamped by a registered California Structural Engineer.

1.5 SUBMITTALS

A. Submit support systems details and calculations stamped by a registered California Structural Engineer. The details and calculations shall clearly show the magnitude and location of forces imposed on the structure from the support system and how supports systems is attached to the structure.

B. Submit under provisions of General Conditions, Division 1, Section 013300 Submittal Procedures, Section 016000 Product Requirements, and Section 012500 Substitution Procedures as applicable

C. Indicate hanger and support framing and attachment methods.

D. Submit all insulated and non-insulated pipe supports, hangers, guides and anchors.

E. Provide product data or provide calculations to demonstrate compliance with the requirements of regulatory agencies and reference standards.

F. Provide seismic calculations by California Registered Engineer as required by State, Federal or regulatory agencies.

G. Note compliance with seismic regulations on submittals.

H. Indicate hanger and support framing and attachment methods.

I. Submit all insulated and non-insulated pipe supports, hangers, guides and anchors.

J. Submit, in drawing plan form, exact location and weight at each support point for piping larger than 4 inch diameter in mechanical rooms and fan rooms. Drawing shall include HVAC, plumbing, and fire sprinkler supports.

K. Submit record drawings reflecting actual conditions.

L. Submit shaft support systems and seismic calculations.

M. Refer to Section 230500 Basic HVAC Requirements for start-up requirements.

N. Provide mock-up of each type of pipe support conditions (hangar, penetration, firestop) for review and approval by Owner's Representative. The Owner shall be given 3 days notification prior to review of mock-up.

O. Material VOC Content: Submit manufacturer's printed product data sheets and/or letters of certification on the manufacturer's letterhead for all adhesives, sealants, paints and coatings with evidence that they conform to the "Sustainable Design Quality Assurance" article of this Section for VOC content.

1. Highlight the VOC data for the material in grams per liter.
2. List the quantity of material to be used in gallons or liters.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers:

1. Any manufacturer who can verify compliance with the above requirements.

B. Strut - Channel Framing:

1. Any manufacturer who can verify compliance with the above requirements.

C. Anchors - Drill In:

1. Any manufacturer meeting OSHPD pre-approved standards.

2.2 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the NUSIG standards.

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following:

1. ICC ES evaluation report
2. OSHPD pre-approval

C. Lab test report verifying compliance with OSHPD IR 26-6, Paragraph 1.

D. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips.

E. All overhead concrete anchors or inserts shall be selected from listings within NUSIG-AA and shall have maximum allowable design tension or shear values no greater than those listed within NUSIG-AA.

F. All anchors, inserts or connections to the structure shall be submitted to the structural engineer of record for approval. Submittal review and/or acceptance by the mechanical or electrical engineer of record shall not constitute compliance or usability.

G. Box type inserts which allow movements for horizontal adjustment shall not be allowed, unless engineered solution is provided to assure positive captive positioning and securement of load bearing attachment.

H. All combined tension and sheer anchor or insert attachments shall be engineered.

I. All unusable and/or non-compliance anchors or inserts, shall be cut-off flush with the concrete or removed at the contractor's expense.

J. Job site torque and/or load or pull testing shall not be allowed as justification for use of non-compliance anchors or inserts.

K. Torque testing of anchors shall be allowed to verify compliance of anchor installation, however, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

L. 50 percent of anchors installed in concrete shall be tested in alternate groups, upon failure of an anchor, the next 20 consecutive anchors must pass, before 50 percent alternate group testing can resume.

M. If anchor failures are due to contractor error, retesting of failed anchors as well as consecutive anchor testing to confirm contractor's ability to properly install anchors will be at the contractor's expense.

N. All items attached to or support from structural or immediate steel, shall have a positive assembly and shall be through bolted, welded or clamped to the steel. All clamps shall be constructed of malleable iron or steel and shall include a retaining strap or J-hook.

2.3 PIPE HANGERS AND SUPPORTS FOR NON-SEISMIC BRACING APPLICATION

A. Hangers for Uninsulated Steel or Copper Pipe, All Sizes: An adjustable wrought steel clevis, copper-plated for copper piping.

B. Hangers for Cold Insulated Steel or Copper Pipe, All Sizes (Except Steam Pipe 2-1/2 Inches and Larger): An adjustable wrought steel clevis, sized to suit 360 degree high-density insulation insert.

C. Hangers for Hot Insulated Steel or Copper Pipe, All Sizes, (except steam pipe 2-1/2 inches and larger): An adjustable wrought steel clevis, sized to suit a 180 degree, 20 gauge galvanized sheet metal insulation saddle, 12 inches long.

D. Hangers for Insulated Steel Steam Pipe, Sizes 2-1/2 inches and Larger: Adjustable roller hanger with steel yoke and cast iron roller, with welded insulation protection saddle, size to accommodate insulation.

E. High Density Insulation Inserts: For pipes 2-1/2 inches and larger use 360 degree calcium silicate (waterproofed for chilled water) inserts having a lap jointed 360 degree sheet metal protective sleeve. Thickness of insert shall match pipe covering (insulation) thickness. All inserts shall have an independent lab certified break, crack and/or crush strength equal to or greater than 5 times the applied load. Do not use inserts at seismic brace connection locations without prior written approval from the system design engineer. Do not connect seismic bracing to inserts without prior written approval from the system design engineer. Submit copies of insert manufacturer's independent lab test reports. Replace all cracked, damaged and/or non-compliance inserts at no additional cost to Owner.

F. Multiple or Trapeze Hangers: Steel channels or angles with welded spacers and hanger rods, sized to support load.

G. Wall Support for Pipe Sizes to 3 inches: Cast iron hooks.

H. Wall Support for Pipe, Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe, sizes 5 inches and larger.

I. Vertical Support: Steel riser clamp.

J. Floor Roof Support for Hot Pipe, Sizes to 4 inches, an All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

K. Floor Roof Support for Hot Pipe, Sizes 5 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

L. Design hangers to impede disengagement by movement of supported pipe.

M. Provide copper-plated hangers and supports for copper piping or provide isolator between hanger or support and piping.

N. Provide angles or channels to span joists and distribute load.

O. Do not use wire for either temporary or permanent hanger or support purposes.

2.4 PIPE HANGERS AND SUPPORTS FOR SEISMIC BRACING APPLICATION

A. Hangers for single hanger supported piping shall be steel clevis type.

B. Hangers shall be designed and installed to allow for a minimum 1-1/2 inches of vertical adjustment.

C. Hangers, supports and insulation for conditions which involve thermal and/or building expansion and contraction shall be engineered based on actual field conditions. Hangers shall be designed and installed to allow for vertical adjustment.

D. Trapeze supported piping shall be attached to minimum 12 gauge, 1-5/8 inch by 1-5/8 inch (strut) channel framing or a structurally engineered trapeze hanger support.

E. Items supported by trapeze hangers shall be properly attached at each trapeze location.

F. Hangers shall be painted or plated according to NUSIG standards.

G. Hangers and vertical support rods shall be sized and spaced according to NUSIG or SMACNA.

H. Hangers shall be secured top and bottom by a double nut assembly to the threaded support rod(s).

I. Provide a protective barrier between non-compatible dissimilar metals.

J. High Density Insulation Inserts: For pipes 2-1/2 inches and larger use 360 degree calcium silicate (waterproofed for chilled water) inserts having a lap jointed 360 degree sheet metal protective sleeve. Thickness of insert shall match pipe covering (insulation) thickness. All inserts shall have an independent lab certified break, crack and/or crush strength equal to or greater than 5 times the applied load. Do not use inserts at seismic brace connection locations without prior written approval from the system design engineer. Do not connect seismic bracing to inserts without prior written approval from the system design engineer. Submit copies of insert manufacturer's independent lab test reports. Replace all cracked, damaged and/or non-compliance inserts at no additional cost to Owner.

2.5 PIPE ISOLATORS

A. Provide each hanger or clamp for uninsulated piping with a metal-backed pipe isolating material to isolate sound vibration and electrolysis. Isolators are not required for fire protection sprinkler piping, waste, vent, gas, and downspout piping.

2.6 HANGER RODS

A. Provide steel hanger rods, appropriately threaded. Provide connection points with jamb nuts or double nuts.

2.7 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Lead Flashing: 4 pound per square foot sheet lead for waterproofing; 1 pound per square foot sheet lead for soundproofing.

C. Safes: 5 pound per square foot sheet lead or 8 mil thick neoprene.

D. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.8 SLEEVES

A. Sleeves for pipes passing through exterior or concrete walls and footings: Schedule 40 black steel pipe or Schedule 40 PVC. For waterproof sleeves, use Thunderline Link-Seal or Calpico Sealing Linx.

B. All pipes except sprinkler piping passing through fire-rated walls and floors shall be UL listed fire-rated assemblies. Refer to Division 7 for fire-rated sealants. Pipe insulation carried through the penetration shall comply with the UL system requirement, but shall not be less than required in Specification Section 230716 – HVAC Equipment Insulation and 23 07 19 – HVAC Piping Insulation.

C. Open voids and cavities occurring in pipe sleeves passing through rated walls and floors shall be completely sealed with UL classified Dow Corning Fire Stop Sealant No. 2000 installed in strict accordance with the manufacturer's recommendations.

D. Sleeves for Ducts: Form with galvanized steel.

E. Size sleeves large enough to allow for movement due to expansion and to provide for continuous insulation.

2.9 INSULATED PIPE SUPPORTERS:

A. Insulation Shields: 360-degree insert of high density, 100 psi, waterproofed calcium silicate, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A-527.

1. Pipe supported on rod hangers: Use Models A1000, A2000, A3000, A4000 and A9000.
2. Pipe supported on flat surfaces: Use Models A1000, A2000, A5000, A6000 and A7000.
3. Pipe supported on pipe rolls: Use Models A3000, A4000, A5000, A6000 and A8000.
4. Model designations are by Pipe Shields, Inc. Mason Industries.

5. Insulation Saddles: 20-gauge galvanized sheet metal. Superstrut 180 degrees C-790. Saddle length not less than three times the insulation outside diameter; 12 inch minimum length at each hanger.
6. In accordance with Section 230719 HVAC Piping Insulation.

2.10 MATERIALS

A. Pipe Hangers and Supports:

1. Superstrut, except as otherwise noted, or Unistrut, Mason, B-Line. Superstrut numbers are used.
2. Provide electro-chromate or factory painted finish over galvanized. No plain, "black" hangers allowed.
3. Concrete Inserts and Anchors: No. 452, C-475 or C-302 for new construction. Hilti fastening systems or Phillips Red Head self-drilling anchors for existing concrete. No powder drive anchors permitted. Coordinate with Owner's Representative.
4. Other Individual Horizontal Piping: Series C-711 hangers 3 inches and smaller. C710 hangers 4 inches and larger.
5. Other Individual Grouped Piping: Horizontal channel Superstrut A1200 with Series 702 straps.
6. Risers: Series C-720 at each floor.
7. Beam Clamps: No. U501, U520, with restraining clamp.
8. Install pipe rollers on trapeze supported pipe that is subject to expansion and contraction. All roof mounted pipework to be on rollers.

    a. No. C728 for trapeze supported pipe.
    b. No. C729 on individually supported piping that is seismically braced.

9. Pipe Risers: Provide with bearing plates and two layers of 1/4-inch thick ribbed or waffled neoprene pad loaded to not more than 50 psi. Separate isolation pads with 1/4-inch steel plate. Weld pipe riser clamps at anchor points to the pipe and to pairs of vertical acoustical pipe anchor mountings which, in turn, rigidly fasten to steel framing.
10. Duct Risers: Provide duct riser supports within shafts with suitable bearing plates and two layers of 1/4-inch thick ribbed or waffled neoprene pad loaded to not more than 50 psi. Separate the isolation pads with 1/4-inch steel plate.
11. Dielectric Isolators: All uninsulated copper tubing systems. Use Superstrut isolators, Cush-A-Strip or Cush-A-Clamp on all pipe clamps. For individual hangers, use felt lined hangers.
12. Miscellaneous Steel: Provide miscellaneous steel members, beams, brackets, etc., for support of Work of this Division unless specifically included in other Divisions.
13. Spring Supports for Piping, Equipment and Seismic Bracing: As specified in Section 230548 Seismic Controls for HVAC Piping and Equipment.
14. Safety Hanger Wires:

    a. For air diffusers and other mechanical units to be mounted on suspended-grid ceiling systems and weighing less than 56 pounds per unit, furnish and install safety hanger wires, but not connect, as work under Section 092220 Ceiling Suspension, and to meet requirements as referenced.

b. In advance of ceiling hanger-wire work, provide to jobsite layouts or instructions necessary for proper installation of safety wires.
c. As part of Work under this Division 23:

1) Connect safety wires to mechanical diffusers and equipment.
2) For diffusers and equipment units weighing 56 pounds or more, provide approved hangers as required by UBC Section 47.1814.

B. Pipe and Equipment Wrapping and Coating:

1. The Manville Company No. 22 primer adhesive, 3M, or equal.
2. The Manville Company V10-20, 20-mil thick polyvinyl tape, Scotchwrap, or equal.
3. Standard X-Tru-Coat and Thermofit 25-mil extruded polyethylene, Scotchwrap, or equal.
4. Koppers Bitumastic 70-B enamel.
5. Permacell UG pipe tape, Scotchwrap, or equal.

C. Insulated Pipe Supporters:

1. Insulation Shields: 360-degree insert of high density, 100 psi, waterproofed calcium silicate, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A-527.

a. Pipe supported on rod hangers: Use Models A1000, A2000, A3000, A4000 and A9000.
b. Pipe supported on flat surfaces: Use Models A1000, A2000, A5000, A6000 and A7000.
c. Pipe supported on pipe rolls: Use Models A3000, A4000, A5000, A6000 and A8000.
d. Model designations are by Pipe Shields, Inc. Mason Industries, or equal.

2. Insulation Saddles: 20-gauge galvanized sheet metal. Superstrut 180 degrees C-790. Saddle length not less than three times the insulation outside diameter; 12 inch minimum length at each hanger.
3. In accordance with Section 230719 HVAC Piping Insulation.

D. Escutcheons, Flashings and Sleeves:

1. Escutcheons:

a. One-piece Grinnell, or Beaton-Corbin; Fig. 2 for copper tubing; Fig. 13 for steel pipe, polished chrome plated brass plates with round head set screws. Spring clips not acceptable. Provide at all exposed piping penetrations of walls, floors and ceilings. "Exposed" means all finished rooms, including storage, janitor and mechanical rooms. Where piping is insulated provide escutcheons to fit insulation outside diameter. Where piping requires special escutcheon sizes, manufacture from stainless steel.
b. Escutcheons shall be of sufficient outside diameter to cover sleeve opening and fit snugly around pipe. Provide special deep escutcheons where necessary to cover beads of fittings or sleeves extending through floors.

2. Flashings: Flash and counterflash watertight all pipe and duct penetrations of roofs and exterior walls. Pipes through roofs with M.D. Products No. 65; No. 67 with vandal caps for vents; provide counterflashing sleeves. Other flashings shall be 24 gauge galvanized sheet metal. In accordance with Section 076200 Sheet Metal Flashing and Trim.
3. Make penetrations through any dampproofed/waterproofed surfaces dampproof/waterproof by appropriate means to maintain integrity of system penetrated. Includes penetrations caused by hangers suspended off such surfaces.
4. Sleeves:

    a. Through Interior Concrete Walls and Floors: "Adjust-to-Crete," or A.M.I., telescopic, submerged, adjustable sleeves. Pack annular space between pipe and sleeve tight with fiberglass. Seal both sides with mastic for floor sleeves.
    b. Through fire walls or floors, or lightproof or soundproof walls, floors and partitions: Pack space between sleeve and pipe or insulation with non-shrink grout, ceramic fiber, neoprene coated rope or other approved sealant materials. Install rigid calcium silicate insert on insulated pipe. Approved prefabricated assemblies, Pipe Shields, Tolco.
    c. Provide pipes passing through floors, walls, partitions, roofs or concrete beams with sleeves having internal diameter 1 inch larger than outside diameter of pipe, or of insulation on covered lines, except for sleeves connecting buildings which shall be 1-1/2 inches larger.
    d. Sleeves through outside walls or through slab-on-grade, except soil pipe through slab: Schedule 40 galvanized steel pipe with anchor and waterstop plate and 150 pound galvanized steel slip on welding flange welded at center of sleeve painted with one coat of bitumastic paint inside and outside. Pack space between sleeve and pipe with lead wool or oakum to within 2 inches of each face of wall. Pack remaining space and seal watertight with waterproof compound. Metraflex, Metraseal, Fabricated Seals, Thunderline Link-Seal. For steam and condensate lines, provide Metraseal HT sliding seal product. This paragraph does not apply for sleeves connecting buildings.
    e. Terminate sleeves flush with walls and ceilings. Where vertical pipes are exposed, extend sleeves 1 inch above finished floor except where escutcheons are required.
    f. Sleeves passing through roof construction: Extend minimum 8 inches above roof, flash and sealed water-tight with safe support of conduit and equipment furnished under each division.
    g. Sleeves through interior walls other than masonry or concrete: 12 gauge galvanized sheet steel, set flush with finished surfaces of partitions.
    h. Sprinklered Areas: Provide water-tight joint between floor and pipe or conduit passing through it by using pipe sleeve projecting 3 inches to 6 inches above the floor in accordance with NFPA 13, caulked at the top of the sleeves with oakum.
    i. Sleeves passing through membrane waterproofing or lead safe: Provide 16 ounce soft sheet copper or four-pound lead flashing extending 12-inches beyond sleeves in all directions; secure to waterproofing or lead safe, turn down flashing into space between pipe and sleeve; insert oakum gasket, pour lead, caulk water-tight.

j. Uninsulated copper pipe through ferrous sleeves or in contact with cement or concrete: Wrap pipe with two layers of heavy plastic protective tape. Finish wrapping flush with sleeve ends.
k. Insulated piping or ductwork through sleeves shall have uninterrupted insulation inside sleeves or openings. For underground penetrations stop insulation at seal.

5. Separate piping through walls, other than concrete walls, from contact with wall construction materials with non-hardening caulking and non-shrinking acoustical caulking.
6. Floor penetrations and fire and smoke rated wall penetrations: Provide a UL listed penetration assembly at each penetration of a rated wall, floor, or ceiling. Section 078400 Firestopping and as follows:

a. Acceptable manufacturers: Pipe Shields, Inc., ProSet "Firestop Penetrators".
b. UL or State Fire Marshal (SFM) listed. Furnish listing number and demonstrate SFM approval.
c. Manufactured, pre-engineered, fire-rated pipe sleeve kits shall be provided for all fire wall and deck penetrations.
d. Sleeve and packing shall have the same fire rating as the partition construction in which they are installed.
e. Bare pipe:

1) All steel pipe or copper tubing penetrating fire walls or decks shall be encircled by sheet metal sleeves, minimum 24 gauge, sized for maximum one inch annular spacing between pipe and sleeve. Pack spacing on each end with UL rated ceramic fiber strip insulation.
2) Pipe Shields, Inc. Models F3000, F3200, F3400, F3600, F6000, F6200, F9000 and F9200.

f. Insulated pipe:

1) Same as for bare pipe, but with the addition of a 360-degree cylinder of waterproofed calcium silicate insulation encasing the pipe and covered with a galvanized sheet metal shielding, all sized to extend to a minimum of one inch beyond wall or deck.
2) All insulated fire-rated wall penetrations shall have the insulation shield grooved if pipe is heat-traced and the groove reinforced as necessary for seismic loading.
3) Pipe Shields, Inc. Models F1000 through F1600, F2000 through F2600, F4000 through F5200, and F7000 through F8200.

g. Plastic pipe:

1) All bare or insulated plastic pipe penetrating fire walls shall be encircled by sheet metal sleeves sized for one inch annular spacing between pipe and sleeve. Spacing shall be packed on each end with UL rated ceramic fiber strip insulation. In addition, there shall be a 360-degree cylinder of waterproofed calcium silicate insulation encasing the pipe and covered with galvanized sheet metal shielding, all sized to extend a minimum of 24 inches beyond the fire wall.

2) Pipe Shields, Inc. Models F1800 and F2800.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Properly support all material, equipment and apparatus. Minimum safety factor of 5, based on ultimate tensile or compressive strength, as applicable, or material used. Turnbuckles and rod couplings capacity not less than attached rod. Calculate with equipment and piping full of water.

B. Use properly manufactured supports throughout. Do not use make-shift materials such as wire, tape, wood blocks, etc.

C. Comply with applicable requirements of ANSI B31.1 for piping.

D. Trapeze suspension (trapeze hangers may be used for parallel lines if pipes pitch same direction): Size channel assembly in accordance with manufacturer's published load ratings. Deflections not to exceed 1/360 of a span (refer to Superstrut load tables).

E. Do not cut or weld to any structural steel without permission of Owner's Representative.

F. Isolate pipe supported by clamps or hooks from supports and building construction with felt.

G. Clamps shall not anchor piping, unless anchoring is required.

H. Supports from wall shall be steel brackets, hooks, clamps attached to wall structure with anchor bolts.

I. Install riser clamps at each floor. Install metal channel intermediate supports midway between riser clamps.

J. Resiliently isolate any copper piping with pipe insulators to prevent steel to copper contact.

K. Fabricate special pipe support systems and racks from steel angle or section and in accordance with Section 01600 Product Requirements, Section 15060 Piping Supports, Guides, Hangers and Anchors and Section 01720 Preparation.

L. Minimum Pipe Hanger Spacing:

1. Support vertical risers at their bases and at each floor minimum. Copper piping less than 1-1/2 inch diameter and steel piping less than 3/4-inch diameter shall have one intermediate support between floors.
2. Support every pipe branch over 3 feet long.

M. Support horizontal as follows:

Pipe Size (Inches)	Clamp (Supers trut)	Rod Size (Inches)	Center to SCH 40 Steel Stainless	Copper	Cast Iron (Feet)	PVC SCH 40	PVC SCH 80
1/2 - 1	C-711	3/8	8	6	-	4	4
1-1/4 - 1-1/2	C-711	3/8	8	8	10	4	6
2	C-711	3/8	10	8	10	4	6
3 - 4	C-711	1/2	12	12	10	4	8
5	C-710	5/8	14	12	10	4	8
6	C-710	3/4	14	12	10	4	8

N. Support any cast-iron piping with no fewer than two supports each section and within 18 inches from both sides of each joint. Maximum 5 foot intervals except for pipe exceeding 5 foot length, provide supports at intervals equal to pipe length but not exceeding 10 feet.

1. Install hanger within 12 inches of each change of direction and for each branch 5 feet and longer.
2. Support refrigerant piping within 6 feet of equipment and within two feet of each bend or angle.

O. Adjust each hanger to carry its proper share of load.

P. Install additional supports or braces if, during test or normal operation, piping should sway, crawl or vibrate. Piping shall be immobile.

Q. Support piping below any ductwork from wall or trapeze with hanger rods outside of ductwork.

R. Support piping including valves, etc., independently of equipment; no piping weight or stress due to expansion, construction to be transmitted to equipment. Contractor is responsible for proper alignment of piping at equipment in all conditions (maximum hot to minimum cold); install anchors, guides, bracing and spring supports as required. Flexible connections, expansion joints' deflections shall be always within allowable limits. Do not install piping at equipment until inspected for alignment at extreme temperature conditions.

S. Pre-insulated pipe supports shall be installed while the pipe is being erected.

T. Pipe Guides: U.S. Flex Reflex-Mave, Type M, Flexonics. Sizes suitable to receive insulation.

U. Thrust Blocks:

1. All buried pressure piping with friction type joints (bell and spigot, Tyton, etc.) shall have adequate concrete thrust blocks installed at each change of direction (horizontal, vertical), at each tee and dead end. Anchor pipe at entrance to building.

V. Wrapping and Coating Installation:

1. Buried piping: Wrap all uninsulated, buried, steel and copper piping and fittings as follows:

a. Thoroughly clean piping and fittings of loose scale, rust, dirt, oil and grease before wrapping. Wire brush as required; use solvent for removal of oil and grease.
b. Coat with primer adhesive.
c. Wrap with polyvinyl tape. Stretch tape tight during application. Overlap tape to result in double thickness.
d. Check all wrapped pipe with electric type holiday tester. Patch holidays prior to backfill and/or pour.

3.2 INSERTS AND DRILL-IN ANCHORS

A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable. All inserts and anchors shall be installed according to the NUSIG standards.

B. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 4 inches in diameter or ducts over 60 inches wide.

C. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

D. Locate expansion shields in concrete beams a minimum of 6 inches above bottom of beam.

E. Do not use friction spring-type clips.

F. Use hangers which are vertically adjustable after piping is erected.

3.3 PIPE HANGERS AND SUPPORTS

A. Support piping joined with grooved couplings per coupling manufacturer's installation guidelines.

B. Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.

C. Support piping at each change in direction, at ends of branches, at base and top of risers, pipes and drops, and wherever necessary to prevent sag, bending, or vibration, in addition to the above listed hanger spacing.

D. Use hangers which are vertically adjustable 1-1/2 inches minimum after piping is erected.

E. Support horizontal soil pipe on both sides of each joint, with 5'-0" maximum spacing between hangers.

F. Support vertical piping at every other floor. Support vertical soil pipe at each floor at joint.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple individual hangers or trapeze hangers.

H. Where practical, support riser piping independently of connected horizontal piping.

I. Support nonmetallic piping with a sufficient number of hangers to prevent sagging and misalignment.

3.4 DUCT HANGERS AND SUPPORTS

A. Where ducts are not seismically braced, use duct hangers, supports, and installation per SMACNA Standards.

B. Contractor is responsible for preparing documentation for pre-approved systems, including submittals required for State approval.

3.5 PRIMING

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipes shafts and suspended ceiling spaces are not considered exposed. See NUSIG standards.

3.6 FLASHING

A. Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes with 24 inches x 24 inches sheet lead, minimum 8 inches above roof. Counterflash with caulked stack flashing sleeve, Zurn Z-196.

C. Provide 12 inches minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.7 SLEEVES

A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

B. Where piping or ductwork passes through floor, ceiling or non-fire-rated wall, close off space between pipe or duct and construction with noncombustible insulation. Provide tight-fitting metal caps on both sides and caulk.

C. Install chrome-plated escutcheons where piping passes through finished surfaces.

D. Provide pipe sleeves for all mechanical piping.

E. Adequately sleeve pipe passing through concrete or masonry walls or concrete slabs to receive both pipe and insulation pertaining thereto.

F. Waterproof sleeves shall be Thunderline Link-Seal or Calpico Sealing Linx.

G. Seal pipes passing through walls or slabs. Use mastic or oakum seal in the annular space in nonfire-rated walls.

H. Insulated pipe shall be insulated in sleeves, sealed, and pointed as above.

I. Install sleeves on pipes as they are being hung, ready for proper placement in wall as wall is being constructed.

J. Where sleeves have been inadvertently omitted in concrete floors, provide requisite pipe opening by using properly sized diamond core drills after coordination with Structural Engineer. Areas located below drilling operations shall be protected from possible damage.

END OF SECTION 230529

SECTION 230530 – PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all piping and pipe fittings necessary for complete installation as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Section 230500 - Basic HVAC Requirements.

B. Section 230529 - HVAC Pipe Supports, Guides, Hangers and Anchors.

C. Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 230523 - General Duty Valves for HVAC Piping.

E. Section 232113 - Hydronic Piping.

1.3 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit under provisions of General Conditions, Division 01, Section 013300 - Submittal Procedures, Section 016000 - Product Requirements, and Section 012500 - Substitution Procedures as applicable.
2. Furnish the following:

    a. Manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting.
    b. Piping schedule showing manufacturer, pipe weight, fitting type, and joint type for each piping system.

3. Refer to Section 230500 - Basic Mechanical Requirements for start-up requirements.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

B. American Water Works Association, Inc. (AWWA).

C. American National Standards Institute (ANSI).

D. Federal Specifications (FS).

E. Military Standard (MIL STD).

PART 2 - MATERIALS

2.1 PRESSURE PIPING

A. Conforming to requirements of ANSI Safety Code for Pressure Piping B31.1; commercially round and straight; of uniform quality and workmanship; free from all defects; identified. Refer to Section 232213 23 Steam and Steam Condensate Piping for additional requirements.

B. Pressure ratings herein are steam, unless specifically designated as "W.O.G." or "Water Working Pressure".

C. Black Steel, Seamless, Threaded: ASTM A53, Grade B, Schedule 40 or 80; threaded, black, cast-iron banded fittings, ANSI B16.4, 125-pound class, ANSI B1.20.1 threads; or malleable iron, ANSI B16.3, 150-pound class, ANSI B1.20.1 threads.

D. Black Steel, Seamless, Welded: ASTM A53, Grade B, Schedule 40 or 80; steel welding-neck fittings, ANSI B16.9; steel welding-neck flanges and flanged fittings, ANSI B16.5, 150-pound class, raised face.

E. Galvanized Steel, Seamless, Threaded: ASTM A53, Grade B, Schedule 40 or 80.

1. Fittings: Threaded, galvanized malleable-iron fittings and ground-joint unions, ANSI B16.3, 150-pound class, 4 inches and smaller; threaded, cast-iron flanges and flanged fittings, ANSI B16.1, 125-pound class, at valves and piping specialties 2-1/2 inches and larger, and at all connections 5 inches and larger.
2. Combination standpipe fittings: Threaded, galvanized, malleable iron, ANSI B16.3, ASTM A-197, 150-pound class, or threaded, galvanized, cast-iron, ANSI B16.4, 250-pound class; threaded, cast-iron flanges and flanged fittings, ANSI B16.1, 250-pound class. Use flanges at all connections 8 inches and larger.

F. Cast Iron, Mechanical Joints: ANSI A21.6, 150-pound class, centrifugally cast, bituminous coated underground; ANSI A21.11 mechanical joints; ANSI A21.4 cement lined; or ductile iron, ANSI A21.51 and AWWA C151, 150-pound, cement lined in accordance with ANSI A21.4, bell and spigot ends with mechanical joints, ANSI 21.11, cement lined fittings 12 inches and smaller ANSI A21.10, bituminous coated underground.

G. Mechanical Grooved Piping System: In lieu of previously specified welding, flanging or threading, the Contractor may, at his option and where permitted by code, provide a complete Victaulic, Gruvlock, or equal mechanical grooved piping system. This system includes the following:

1. Heating water, chilled water and condenser water.
2. All grooved products shall be of one manufacturer.

3. Provide Style 77 flexible couplings where expansion, contraction, deflection or sound attenuation is required such as at vibrating mechanical equipment and valving and at seismic expansion joints. Use Style 107 rigid couplings with angle bolt pattern design everywhere else to make a weld-like rigid joint where sound or vibration isolation is not required, including at other grooved end valves and equipment, all risers, non-accessible concealed locations, horizontal runs or any other areas where no movement is desired. Grade E minimum, EPDM gaskets with temperature range of -30 degrees to +230 degrees F. Couplings and fittings with minimum UL listed and FM approved 300-psig working pressure.
4. Couplings above 12 inch size use AGS two piece type fittings.
5. Provide ISO 9001 certification on grooved piping systems.
6. Manufacturer of grooved piping system must manufacture its own gaskets under ISO 9001 certification.
7. Provide grooving machines same manufacturer as grooved piping system.

H. Copper Tubing: ASTM B88, seamless, hard temper for all piping; Type K for systems specified and all piping underground; Type L for all other piping; wrought-copper, solder joint fittings, ASTM B75 in sizes available; cast-bronze solder-joint fittings, ANSI B16.18, only in sizes not available in wrought copper; cast-bronze, threaded, ground-joint unions, ANSI B16.18, 2-inches and smaller; cast-bronze, flanged unions, ANSI B16.24, 150-pound class, 2-1/2 inches and larger.

1. Use 15 silver solder with 15 percent silver, 80npercent copper and 5 percent phosphorous for the following:

   a. Copper piping 1-1/4 inch and larger.
   b. Concealed piping.
   c. Steam condensate piping.
   d. Underground or underfloor piping.
   e. Refrigerant pipe.

2. Use 95-5 tin antimony solder for the other copper pipe.

I. Chemical Transfer Piping:

1. Stainless Steel pipe: Schedule 40 seamless low carbon Type 316, fully annealed, stainless steel hydraulic tubing ASTM A 269 (hardness RB80 or less).
2. Fittings and joints: Type 316 ASTM A812 socket weld type, Swagelock, Ladish F316L or equal. Heavy duty single pin sanitary clamp fittings and joints at connection between chemical waste gravity drain lines and reservoirs. Tri-Clamp or equal, (no known equal).

J. Stainless Steel: Schedule 40 seamless low carbon Type 316, fully annealed, stainless steel hydraulic tubing ASTM A 269 (hardness RB80 or less) fittings Type 316 ASTM A812 socket weld type, Swagelock, Ladish F316L.

2.2 FITTINGS AND FLANGE

A. Standard products as manufactured by Crane, Stockham, Mueller or equal or the respective manufacturer of the piping as hereinbefore specified.

B. ASTM A338, ANSI B16.1, 150-pound, black.

C. Provide Henry or Wolf-Linde ASTM 105 flanges for refrigerant system.

D. For high temperature hot water, 300 psi class forged steel, raised face weld neck or slip-on flanges, ASTM A181, ANSI B16.5.

2.3 FLANGE GASKETS

A. Crane "Cranite", Grinnell, or equal, 1/16-inch asbestos-free full face sheet packing for cast iron and bronze flanges, raised face for steel flanges, ANSI B16.21. Coat gaskets with thread lubricant before installation.

2.4 FLANGE BOLTS

A. Open-hearth bolt steel with square heads with cold pressed hexagonal nuts, cadmium or zinc plated, ASTM A307, ANSI B18.2.

2.5 UNIONS

A. General: ANSI B16.39, hexagonal stock, ball-and-socket joints, metal-to-metal bronze seating surfaces, female threaded ends ANSI B1.20.1 threads.

B. For Steel Piping 2 Inches and Smaller: Grinnell Fig. 554, or Crane, 250-pound ground joint.

C. Steel Piping Larger Than 2 inches: Welding flanges as specified.

D. Copper Piping: Mueller No. WC-407, Chase, or equal.

E. Dielectric Unions, 2 Inches and Smaller: EPCO Model FX, 250-pound WOG, with standard gaskets for plumbing and high temperature gaskets for heating. Provide unions with 6 inch brass nipples. For heating, use brass fitting with no dielectric union. Use run 6 inch brass length for dissimilar metal connection.

F. Dielectric Unions, 2-1/2 Inches and Larger: EPCO Model X brass half-union, Grinnell, or equal. ANSI B16.1, 175-pound WOG; to welding flange as specified.

G. The Victaulic, Gruvlock, or equal dielectric waterway may be used as required.

2.6 EXPANSION JOINTS

A. Hyspan, Metraflex, Metraloop, Mega Flex, Microflex, Flexonics or equal, 175 psig, 850 degrees F, with pipe guides and pipe anchors. Pipe for seismic joints shall be Schedule 40. Movement capability as required and determined through manufacturer analysis. Install guides and anchors in strict accordance with manufacturer's recommendations.

2.7 FLEXIBLE PIPING braided hose

2.8 Al Milmac, Metraloop, Metraflex, Megaflex, Microflex, Flexonics Series or equal in applicable sizes, all service stainless steel flexible metal hose, T-321 corrugated stainless steel close pitch hose, annular corrugations and T-304 stainless steel braid. 450-pound working pressure at 70 degrees F, braided hoses with the following minimum live lengths (for 8 inch motion):

Pipe Size	Live Length (inches)	Pipe*
3/4-inches and smaller	24	Copper
1 inch	24	Copper
1-1/4 inches	26	Copper
1-1/2 inches	27	Copper
2 inches	30	Copper
2-1/2 inches	32	Copper
3 inches	31	Steel
4 inches	34	Steel
6 inches	42	Steel

A. *Use lengths for other pipe materials to achieve same performance. Not for use as isolators at equipment connections.

B. Provide 3/4 inch braided hose at reheat coil connections.

C. Provide braided hose connections at fan coil units.

D. Support mid point of braided hoses with cable and ring to avoid interferences with other utilities and maintain adequate clearance above ceilings.

2.9 CONNECTIONS TO EQUIPMENT

A. Mason SFDEJ flexible twin sphere for applicable sizes, peroxide cured EPPM covers and liners, Dacron tire cord frictioning, ductile iron external ring between spheres sizes 2 inch and larger, flexible coupling suitable for 250 psig at 190 degrees F. Flexible braided hose not acceptable as vibration isolator at equipment.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - GENERAL

A. Work into complete, integrated arrangement with like elements to make work neat appearing, finished.

B. Run concealed, except as shown otherwise; where exposed, parallel with walls or structural elements unless so indicated on Drawings or approved by Owner's Representative; vertical runs plumb; horizontal runs level, parallel with structure or uniformly pitched as appropriate.

C. Install with adequate passageways free from obstructions, as high as practicable to maintain adequate head room, as shown or required. Notify Owner's Representative before installation whenever head room of less than 8 feet 0 inches will result. Coordinate with Work of other Divisions to achieve proper head room as specified in this Division.

D. Clearance: Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.

E. Cleaning and Closing: Inspect all piping and equipment before placing; clean interior before closing. Close piping and ductwork as end of each day's work.

F. Not all offsets in ductwork or piping are shown. Contractor to decide which item to offset or relocate. Maintain required slope in piping.

G. Use specified manufactured supports throughout. Do not use makeshift materials such as wire, tape, wood blocks, etc., in lieu of proper supports.

3.2 INSTALLATION OF PIPING

A. Definition of "Piping": The term "piping" as used in Drawings or in these Specifications, means all pipe, fittings, nipples, flanges, valves, unions, hangers, etc., as may be required for a complete, functional system.

B. Except for large scale details, piping is diagrammatically indicated. Install generally as shown. Do not scale Drawings for exact location of piping. Install piping to best suit field conditions and cooperate with other trades. Sizes are given on Drawings.

C. Offset piping wherever necessary to obtain head room. In all cases, install pipe lines to conform to actual conditions such as offsetting to clear structural members, lights, ducts, etc. Run piping true to line and grade. The finished work shall present a neat and workmanlike appearance.

D. Securely fasten piping and equipment in the building to the building construction. Secure branch piping runouts in partitions to steel partition members with approved clamp. Provide pipe taping separation between steel and copper.

E. Arrange piping neatly along walls or in neat, horizontal groups; each group to be in one plane, insofar as possible, and maintain required slope.

F. Do not sleeve structural members without consent of Owner's Representative.

G. Wherever possible install hot piping not nearer than 1 foot from uninsulated, cold piping.

H. Provide bracing to prevent lateral motion of suspended materials. Comply with "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping System" in compliance with OSHPD No. R0001.

I. Accurately cut pipe and work into place without springing or forcing, except when cold springing is required.

J. Install pipe lines free from traps and air pockets. Arrange water piping for draining at low points and vent at high points free from traps, sags and bends.

K. Piping in any partitions, through plates, studs, etc., shall have sufficient clearance from structure to allow for expansion, contraction of piping. No bare piping shall touch wood, concrete, metal, etc., at any time. See Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment for vibration and seismic control.

L. Maintain 1-inch clear from piping to sheet rock or other wall covering.

M. Wherever changes in size of pipes occur, make changes with reducing fittings. The use of bushings will not be permitted on pressure piping.

N. Provide piping passing through finished floors, ceilings, partitions, or walls exposed to view with chromium-plated escutcheons. Fit escutcheons for insulated pipe over insulation.

O. Flash pipes piercing roof membranes watertight. Fit hot pipes with a welded cowl and air space between cowl and flashed curb to allow for any expansion.

P. Seal penetrations of acoustical barriers with acoustical sealant.

3.3 PIPING JOINTS

A. Perform pipe cutting and end preparation to result in clean ends with full inside diameter. Grind and ream burrs.

B. Pure lead and graphite lubricant on non-potable systems, Key-paste, Thread-Tite compound or Permacel P-412 or approved equal 1/2-inch wide teflon pipe joint sealant tape. Apply to male threads only.

C. Welded Joints:

1. Welding of pressure piping to be done by welders who have been qualified by a recognized agency within 6 months prior to date of the Contract. Perform welding in accordance with provisions of latest issue of all applicable codes including ASME Boiler Construction Code and ANSI Code for Pressure Piping, Standard Procedure Specifications of, and operators qualified by National Certified Pipe Welding Bureau will be considered as compliance with requirements of Specifications.
2. Where required, peen and wheel-grind welds. Ends of pipe may be burned for welding; however, grind bevel and remove scale before welding joint. Ragged edges with metal beads, poor alignment, and other inferior work will be rejected.

3. Perform welding with oxyacetylene or electric arc process. Use electric arc for stainless steel without flux.
4. Use long radius forged-steel welding elbows.

D. Mechanical Grooved Joints:

1. Cut or roll grooved. Grooves in accordance with latest manufacturer's published recommendations. All components of the mechanical grooved piping system in accordance with the manufacturer's latest specification for temperature pressure and suitability.
2. Manufacturer provide instruction manuals and assist the Contractor in training assembly personnel. Submit notification of instruction.
3. Use only grooving tool specifically designed for this system.

E. "Plastic" Piping and Joints:

1. Install in strict compliance with manufacturer's published installation instructions and Division 22 - Plumbing. Submit installation instructions.
2. Provide factory representative to instruct contractor personnel as to installation procedures prior to commencement of work. Submit procedures and written certification of instruction. Include signatures of instructor, and Contractor's field supervisor and personnel by name.
3. Pipe material through fire rated floors or walls to be metal pipe approved for the service.
4. Include in submittals manufacturer's product specifications sheet listing all requirements of this specification and chemical and physical properties of product.

F. Soldered and Brazed Joints:

1. Clean surfaces to be jointed, of oil, grease, rust and oxides. Medical compressed air and gases per NFPA 99. Clean socket or fitting and end of pipe thoroughly with emery cloth to remove dust and oxides. After cleaning and before assembly or heating, apply Handy or Aircosil Flux to joint surface and spread evenly.
2. Cut copper tubing with copper tube cutters, size with sizing tool, and thoroughly clean before application of flux and solder.
3. Comply with ANSI B31.5 for pressure piping and ANSI B 9.1 for refrigerant piping.
4. For steam condensate systems, fill pipe and fittings during brazing with inert gas such as nitrogen or carbon dioxide to prevent formation of scale.

G. Steel Pipe:

1. Only use American Standard pipe threads for IPS threaded work. No screwed pipe joints shall be caulked or screwed up with rope or packing of any kind. In making up joints in pipe lines, ream out the burrs formed by cutting pipe.
2. Unless otherwise indicated, welding shall be permitted on 2-1/2 inches and larger black steel pipe lines. Welding fittings shall be standard weight forged seamless steel.
3. Use Model CSX and CSX-CW Series when pipe hangers span greater than 10 feet and for all pipe roller applications.

H. Copper Tubing:

1. When erecting plated, polished or soft metal tubing, friction wrenches shall be used exclusively.
2. Provide 125-pound bronze flanges on copper lines.
3. Provide IPS red brass pipe or nipples at all connections requiring rigidity (at equipment, through roof, at anchors, etc.).
4. Do not crimp tubing. Isolate from contact with steel.
5. All buried copper piping to be wrapped with two layers of Scotchwrap, Trantex #V-10, or V-20 or equal.

I. Copper to Steel Connections:

1. Make all copper pipe connections to ferrous piping with dielectric couplings or isolation flanges. Provide 6 diameters of brass nipple between coupling and steel pipe.
2. Make buried copper or brass piping connections to steel or cast-iron piping with dielectric isolation flanges, field wrapped with two layers of Scotchwrap, Trantex, or equal, applied according to manufacturer's instructions. Each layer of wrapping shall have 1/2 inch overlap. Extend wrapping 5 feet minimum in all directions from connection. Cover taped piping with 15-pound tar of asphalt saturated felt jacket taped in place, to provide protection during backfill.

3.4 FITTINGS

A. Provide standard, manufactured fittings in all cases. Field fabricated fittings are prohibited. Bushings are prohibited on pressure piping.

B. Make branch take-offs with reducing tees or with line size tees and reducers, except that branches less than one-third diameter of main may be made with forged branch welding outlet fittings, Weld-o-Lets, Thread-o-Lets, Vic-o-Lets, Vic-O-Wells, installed as follows:

1. Center punch outlet on main. Electrically drill main to inside pipe diameter of branch takeoff. Chamfer inside edge of hole 1/16-inch minimum and at approximately 45-degree angle. Remove any steel chips that fall into main by use of magnet.
2. Remove all rough edges from inside and outside of pipe.
3. Properly size fittings to fit snugly to outside of main run.
4. Align fitting to drilled opening in main, tack in place.
5. Weld base of fitting to main pipe following manufacturer's recommendations.
6. As each piece of main pipe is completed, but before connecting branch piping, blow out with compressed air.
7. In galvanized piping each piece of main (with fittings welded on) shall be galvanized after fabrication.

3.5 UNIONS

A. Provide union or flange at each connection to equipment between equipment and shutoff valves, on both sides of control valves, downstream of each valve, at each strainer and trap and at piping specialties. Install unions at both ends of valves, strainers, etc., when valves, etc., could not be turned due to an obstruction. When screwed valves, strainers, etc. are specified in welded steel piping, install screwed flanges. Do not install unions where not allowed by code, such as in concealed locations on the natural gas piping system.

B. Provide ground joint unions at all regulating valves, equipment and where required in lines 2 inches and smaller. Use flanges in lines 3 inches and larger. 2-1/2 inch valves and equipment may have unions or flanges at the option of the contractor.

3.6 EXPANSION, CONTRACTION AND BENDING

A. Install piping with provisions for expansion and contraction whether shown or not. Provide expansion loops, swing joints, or expansion joints where indicated or otherwise required. Provide provision for expansion and contraction in mains, risers, runouts and piping and ductwork crossing expansion joints.

B. All piping shall be supported and anchored with provision for expansion.

C. Make allowance for expansion in the installation of all piping so that the usual variation in temperature will not cause under stress at any point. Secure anchor pipes where necessary to properly distribute expansion stresses.

D. Do not bend piping without use of pipe bending machine.

E. Provide anchoring where required, whether shown or not.

3.7 SLOPING, AIR VENTING AND DRAINING

A. Slope piping as indicated, true to line and grade, and free of traps and air pockets. Unless indicated otherwise, slope piping in direction of flow as follows:

Service	Inclination	Slope
Heating & Chilled Water	Up	1 inch per 40 feet
Refrigerant	Up	1 inch per 40 feet
Steam	Down	1 inch per 20 feet
Steam Condensate	Down	1/2-inch per 10 feet
Condensate Drain	Down	1/4-inch per foot
Pumped Steam Condensate	Down from location of equipment to campus site main connection	1 inch per 40 feet
Steam Vents	Up	1 inch per 40 feet
Steam Safety Relief Vent	Up	1 inch per 40 feet

B. Provide eccentric reducers for changes in horizontal heating, chilled and condenser water piping, top side flat. Install as close as possible to connection of greater or smaller size than pipe line (equipment, control valves, etc.).

C. Connect heating water, chilled water and condenser water branch piping to bottom of mains.

D. Provide drain valves and hose adaptors at low points in piping including at base of each riser pipe and for float type controllers. All drain valves accessible.

E. Provide manual air vents at all high points in heating water, chilled water and condenser water. Provide 1/4-inch copper, 180-degree bend pipe so vented water may be discharged into a can in areas other than mechanical spaces.

F. Extend discharge of air vents and coil condensate drain lines in mechanical areas to over approved drain receptacle with air gap.

G. Provide air chambers at high points at air vents same diameter as pipe, minimum 2-inches long.

H. Provide drain valves with hose adaptors at all tanks, air separators, traps, blowdowns and system and equipment drains.

3.8 UNDERGROUND CONDUIT PIPING – CHILLED WATER

A. Underground Chilled Water Piping:

1. Refer to Civil – For Reference Only Section.

    a. Scope of work provided under separate contract.

B. Underground Steam and Steam Condensate:

1. Refer to Civil – For Reference Only Section.
2. Refer to 23 21 13 21 Underground Chilled Water Piping.

3.9 COPPER

A. Do not crimp copper tubing. Isolate copper pipe and tubing from contact with steel. For branch drops and rises to plumbing fixtures, anchor branch to wall with drop-ear ell or tee.

B. All buried copper tubing to be wrapped with two layers of Scotchwrap, Trantex, or equal.

3.10 PIPE ENDS

A. Perform pipe cutting and end preparation to result in clean ends with full inside diameter. Grind and ream as necessary.

3.11 COATINGS

A. Reapply coal-tar coating on buried piping, after installation, to surfaces from which coating has been removed or scraped.

3.12 PROTECTION

A. Keep openings in piping closed during construction to prevent entrance of foreign matter.

3.13 CARE OF FLOORS

A. Do not set pipe vises or threading machines on concrete floors. Cover floor when making plumbing connections to avoid staining floors and bear cost of removing any stains.

3.14 CLEANING

A. Thoroughly flush out domestic water piping with domestic water under pressure before faucets, flush valves and other constantly operated devices are installed.

B. Clean, by flushing, interior of water piping and equipment. Upon completion of flushing, completely drain systems at low points; remove, clean and replace strainer baskets and refill systems.

C. Domestic and Industrial Water Systems' Disinfection: See Specifications under Division 22.

D. Hydronic and Steam Systems: After above specified flushing, draining and refilling of the systems, boil out, for period of 4 hours, with 1 pound of trisodium phosphate for each 60 gallons of water in system. Allow systems to reach design temperature. Upon completion of boiling out, completely drain systems at all low points; remove, clean and replace strainer baskets and refill systems.

3.15 TESTING

A. Provide specified tests and as otherwise required. Provide test certificates. Provide test equipment including test pumps, gages, instruments and other equipment required. Pressure gages graduated in increments not greater than 5 psi; range of approximately twice test pressure. Gage and instruments to have been calibrated within 6 months of test. Provide Owner's Representative with calibration documentation prior to testing.

B. Provide replacement materials and additional labor as may be required to accomplish this compliance.

C. Test various mechanical systems in portions as work progresses. Any system or portion previously tested shall become part of any repeated test when it becomes part of distribution or collection system.

D. Repair leaks by remaking with new material. Makeshift leak stopping methods are not acceptable.

E. Should any piece of equipment or material fail in any of the tests, immediately remove, replace with new; retest system.

F. Maintain test pressure for periods stated, or as directed, without loss in pressure except that due to change in temperature or atmospheric pressure during test. Test time will be accrued only while full test pressure is on.

G. Perform tests in accordance with requirements and under supervision of the Owner's Representative and authorities having jurisdiction. Notify the Owner's Representative at least three (3) working days in advance of any test.

H. Piping:

1. Remove from systems, during testing, equipment which would be damaged by test pressure. Replace removed equipment after testing.
2. Do testing before backfilling or concealing.
3. Test pressure piping completely before pipe work is insulated.
4. In multi-story structure, limit test to 3 floors per test in composite testing of non-pressure systems only.

I. Perform tests in accordance with following schedule or minimum 150 percent of maximum working pressure, whichever is greater. Unless indicated otherwise, "Tolerance" means no pressure drop, except that due to temperature change, in 24-hour period.

System	Medium	Pressure	Tolerance
Heating Water	Water	150 psig	No leaks
Chilled Water	Water	150 psig	No leaks
Steam & Steam Condensate	Water	150 psig	No leaks
Steam Vents	Water	150 psig	No leaks
Pneumatic Air	Air	150 psig	No leaks
Refrigerant Piping	Nitrogen	400 psig	No leaks

* See Section 210500 for additional requirements.
**Domestic water may be used for preliminary testing before cleaning of deionized water system.

J. Piping:

1. General: The Owner's Representative will conduct field inspections and witness all field tests specified.
2. Field tests:

a. Piping leak tests: Before insulation is applied at field joints, pressurize piping to 25 psig air pressure. Test for leaks with soap solution. Repair leaks and repeat test.
b. Piping hydrostatic pressure tests:

    1) Where concrete thrust blocks have been provided, do not begin testing on any section of pipeline until at least 5 days after placing of concrete.
    2) After installation of insulation, casing or jackets, anchor blocks, backfill, and flushing, apply hydrostatic pressure and allow to stabilize to ground temperature while maintaining required psig, plus or minus 10 psi. After stabilization remove pressure source.

c. Conduit casing leak tests: After insulation and casing joints are installed, and before anchor blocks are installed, pressurize conduit casing to 15 psig air pressure. Test for leaks with soap solution. Repair leaks and repeat test.
d. Conduit casing pressure tests: After leak testing and before backfilling, pressurize conduit casing to 15 psig air pressure and allow to stabilize. After stabilization remove pressure source. Casing must hold 15 psig air pressure plus or minus 2 psi, for at least 4 hours. Repeat pressure test after backfilling. Repair leaks and repeat test.

3. Operational test: After completion of the system, or a testable portion thereof, operate system for not less than 6 hours at operational temperatures and pressures to demonstrate satisfactory function. Check the movement of each expansion joint, and operate each valve in both cold and hot conditions.

END OF SECTION 230530

SECTION 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work of this Section.

1.2 DESCRIPTION

A. Engineering for all bracing, anchorage and seismic restraints.

B. Vibration isolation for all rotating equipment, inertia bases, and equipment support frames.

C. Vibration isolation for piping and ductwork, including resilient attachments.

D. Seismic restraints for all vibration isolated and non-vibration isolated equipment, piping, ductwork and inline devices.

E. Supervision and inspection of installed vibration isolation hardware.

F. The contractor is responsible for selecting, engineering, and incorporating all bracing, anchorage and seismic restraints. Such restraints must not reduce the vibration isolation capabilities of the system.

1. Engineering for support systems, including intermediate members.

1.3 QUALITY ASSURANCE

A. Design Criteria:

1. Anchorage and Bracing: Anchor, support and brace all piping and ductwork to resist seismic forces in accordance with requirements for anchorage bracing as specified.
2. Vibration Isolation: Provide isolation to avoid excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork or conduit.

B. Testing Laboratory:

1. Testing Laboratory will test expansion bolts as specified in Section 055000.

C. Requirements of Regulatory Agencies:

1. CCR - California Code of Regulations, Title 24, Building Standards.

a. Part 6, Special Building Regulations.
b. Chapter 23, Table 23-P.

D. Reference Standards:

1. "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems," OSHPD pre-approved No. R-0100.
2. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
3. Codes and Standards for Noise Control:

a. ASTM E90 - American Society of Testing and Materials: Method for Measuring Sound Transmission Loss
b. ASTM E413 - American Society of Testing and Materials: Determination of Sound Transmission Class
c. ASTM E477 American Society for Testing and Materials: Test of Duct Lining and Silencer Performance
d. ASTM C423 American Society for Testing and Materials: Method for Measuring Sound Absorption
e. ADC 1062R-4: Air Diffusion Council: Certification Rating and Test Manual
f. ANSI S1.13 American National Standards Institute: Measurement of Sound Pressure Levels
g. ARI 575 American Refrigeration Institute: Measurement of Sound in Equipment Rooms
h. ARI 443 American Refrigeration Institute: Standard of Sound Rating of Fan Coil Air Conditioners
i. ASHRAE 36-72 American Society of Heating, Refrigeration and Air Conditioning Engineers: Determination of Ventilating Equipment Sound Power
j. AMCA 300 Air Moving and Control Association: Determination of Fan Sound Power Levels

1.4 DESIGN RESPONSIBILITY

A. Design support and anchorage systems in accordance with procedures indicated herein and in Section 014000.

B. Seismic anchorage of all MEP systems for this project shall be in accordance with the following design criteria:

1. 2013 California Building Code (CBC) for hospitals.
2. Seismic design force per ASCE 7 Section 13.6 as modified by the CBC 2013 Section 1616A using the following coefficients: Sds = 1.0, Ip = 1.5, and Rp & ap in accordance with ASCE 7.

C. Suspended mechanical piping, ductwork and equipment shall be attached to the structure, supported by and seismically braced to meet current CBC requirements.

D. The anchorage details for MEP equipment provided in the drawings have been reviewed and approved by OSHPD. Contractor shall submit the equipment anchor information listed below to justify the use of the anchorage details in these drawings for review and acceptance by the design team.

1. Show that the actual operating weight of equipment is not 10 percent greater than the equipment operating weight shown on the drawings.
2. Show that the actual height of equipment and height to center of gravity area are not 10 percent greater than heights shown on the drawings.
3. Show that the actual plan dimensions of equipment (width and length) are not less than the dimensions shown on the drawings.
4. Provide that the actual equipment anchor detail to be used clearly matches the anchorage detail shown on the drawings.

E. Contractor shall provide the equipment anchorage design for each piece of equipment where the anchorage details on the drawings cannot be justified for ruse (see Note 2). For equipment that the Contractor must provide the anchorage design, the Contractor shall submit the items listed below for review and acceptance by the design, SEOR and OSHPD.

1. Equipment anchorage details that clearly show the method of attachment and bracing to the structure. These details shall be coordinated with the actual structural system on this project. ICC ES report numbers shall be provided in the details for all connectors. If pre-approved OSHPD system is used, then pre-approved number shall be shown. Details shall be stamped and signed by a licensed Structural Engineer in the State of California.
2. Equipment anchorage calculations designing all of the components of the equipment anchorage system. The calculations shall clearly show the magnitude and location of the forces imposed on the structure. Calculations shall be stamped and signed by a licensed Civil or Structural Engineer in the State of California.
3. Equipment listed in 2013 CBC Section 1616A.1.18 are exempted from plan review.

1.5 SUBMITTALS

A. Product data and current OSHPD Certification Number verifying that the system is currently pre-approved by OSHPD, or provide calculations to demonstrate compliance with the requirements of regulatory agencies.

B. Submit anchorage and bracing calculations stamped and signed by a California-registered Structural Engineer for all equipment as required by State, Federal or regulatory agencies. Calculations shall clearly show equipment weight, equipment center of gravity, location of attachment to the structure, and the seismic and gravity forces at each attachment location. Include designs for the attachment of the equipment or equipment support base to the structure, and the equipment to the support base.

C. Note compliance with seismic regulations on submittals.

D. Submit record drawings reflecting actual conditions.

E. Submit in drawing plan form, exact location and weight at each support point for floor mounted and suspended equipment and piping larger in mechanical rooms, fan rooms and penthouse. Drawing shall include HVAC and HVAC piping.

F. Submit for each isolator calculation to substantiate the size; quantity, location and connection to structure; complete manufacturer's description; actual loading at each isolator for floor mounted and suspended equipment and piping larger than 4 inches diameter in mechanical and fan rooms, static deflection, spring outside diameters; and free, operating and solid heights of coils.

G. Submit vibration isolation for all equipment in one package, not as part of equipment submittals. All isolators to be of one manufacturer.

H. Coordinate size, shape and location of concrete pads with Section 033000.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:

1. Vibration Isolation:

   a. Provide vibration isolation by manufacturer with a system that has a valid OPM.

2. Gravity and Seismic:

   a. Provide supports by manufacturer with a system that has a valid OPM.

3. Supports:

   a. Superstrut.
   b. Grinnell.
   c. Tolco.

B. Pipe and Duct Seismic Supports:

1. Provide pre-approved OSHPD certification number or provide calculations demonstrating compliance with regulatory requirements.

C. Concrete Anchors: OSHPD approved anchors.

D. Vibration Isolation:

1. General: Provide only products with current OSHPD certification number or products furnished with calculations demonstrating compliance with one of the OSHPD pre-approved systems: 1. OSHPD OPM-004-13 Mason Industries, Inc. Seismic restraint components for suspended utilities. 2. OSHPD OPM-0052-13 B-Line/Tolco Seismic bracing and support systems. Mason numbers used below.

a. Isolators shall be selected by the supplier, even if sizing is shown. Size vibration isolators on single piece of equipment for equal static deflections based on actual static and dynamic weight distribution per point of support furnished by equipment manufacturer. Dynamic loads include those due to: wind, fluid flow, thrust and rotations inertial. Select each isolator independently for the load distribution on the equipment base, duct or pipe support.
b. In determining weight of equipment, include concrete inertia bases, grout filled pump bases, etc.
c. All static deflections are nominal. Actual installed deflections are to be +15 percent of the specified value.
d. Where static deflections are not specified, provide minimum 2 inch deflection for rotating and reciprocating equipment.
e. Use as few isolators on each equipment as practical. For example, 4 isolators on small equipment and inertia bases.
f. Vibration isolators shall have either known height without a load or other markings so that after adjustment, when fully loaded, the deflection can be verified.
g. Incorporate a resilient neoprene element of 1/4-inch minimum thickness on spring hangers to prevent solid contact between the spring and isolator housing.
h. Install thrust restraints on fans over 3 inches wg static pressure with the same deflection as isolators supporting the fan.
i. All spring isolators laterally stable with leveling bolts. Spring isolators minimum additional "travel" to full compression of half the rated deflection. The ratio of lateral to vertical stiffness shall be 0.9 minimum and 1.5 maximum.
j. Provide all floor-mounted spring isolators with mounting base plates that provide for bolting to the floor and incorporate 1/2-inch thick neoprene bearing pads.
k. Provide EPDM or equal elastomeric elements in place of neoprene on all vibration isolators installed outdoors.
l. Provide neoprene material with anti-ozone and anti-oxidant additives.
m. Seismic design force per ASCE 7 Section 13.6 as modified by the CBC 2013 Section 1616A.
n. Supply all miscellaneous steel to make support compatible with equipment.
o. Confirm seismic calculations and compatibility with particular equipment to be installed. Submit seismic calculations.
p. Mount motors on rigid base common with equipment or supported from equipment frame.
q. Snubbers must not limit vibration isolation capability during normal operation. Where steel limit stops are used, provide 3/4-inch thick neoprene to prevent metal-to-metal impact.
r. Vibration isolation manufacturer representative to supervise and inspect all installed isolation hardware and generate punchlist for Construction Administrator along with corrective measures required. Submit inspection report.

2. Isolator types: Type of mounting and supporting base and minimum static deflection, as scheduled and required. Mason model numbers used.

a. Base mounts:

1) Type NP: Neoprene Pad: Waffle, ribbed or other forms. Typically 3/4 inch thick. Durometers of 40 to 50. Static deflections from 0.125 inch. Provide steel load distribution plates. Size of pad to be specified by isolator supplier based on load per point. Provide grommetted bolt when anchoring. Mason "Super" W and WM.
2) Type NM: Neoprene mounts. Molded one-piece assemblies with skid resistant base plates and mounting holes. Double deflection type with static deflection range from 0.3 to 0.5 inch. Coat metal surfaces with neoprene to prevent corrosion. Provide friction pad. Mason ND.
3) Type USM: Unhoused spring mounts. Single or multiple bare steel springs, baseplates with neoprene pad. Height saving mounting brackets where applicable, height adjustment bolts. Static deflection range from 1.0 to 5.0 inches nominal. Mason SLF with C-spring.
4) Type SSM: Seismic spring mounts. Single spring, leveling device, maximum 1/4-inch travel. Spring diameters no less than 0.8 of compressed height of spring at rated load. Minimum additional travel to solid equal to 50 percent of rated deflection. Spring inspection ports. Static deflection range from 1.0 to 5.0 inches nominal. Withstand 1.0G acceleration in all directions. Mason SSLFH.
5) RSC: Roof spring curb. Roof-mounted spring curbs with continuous perimeter structural steel curb supporting laterally stable coil springs sitting on 1/4-inch neoprene pads. Springs vertically and laterally restrained using neoprene isolated bolts. Provide leveling bolts and cadmium plated or galvanized hardware. Mason RSC.

b. Hangers:

1) Type NH: Neoprene hangers. Molded neoprene units in a steel hanger frame. Double deflection types with static deflection range from 0.3 to 0.5 inch. Designed to preclude contact of hanger rods with frame (30 degrees misalignment). Insert neoprene bushing where rod passes through housing. Mason HD.
2) Type SH: Hanger containing spring in series with deflected neoprene element, load transfer. Same as Type NH with yoke assembly and indicator for load transfer seat spring in neoprene cup with washer to distribute load evenly to cup and to prevent spring-to-casing contact. Mason PC 30N for piping. RW30 for equipment.

c. Seismic Snubbers:

1) Type SS: All-directional seismic snubber. Mason Z-1225 or equal.

d. Risers:

1) Type PC: Vertical riser piping support/suspension. Pipe clamps supported on each side from structure through appropriate isolator and static deflection as specified in Section 230529. Multiple points of support acceptable, but must be engineered, complete with detailed installation and adjustment instructions by supplier.
2) Type DS: Vertical duct risers in shafts. Support with appropriate isolator as specified in Section 230529.

3) Type RG: Vertical riser guides. Telescoping steel tube separated by a minimum ½ inch of 60 durometer or softer neoprene. Guides shall be capable of 1-5/8 inch motion, or meet local requirements. Mason VSG, VSGH.

e. Resilient attachments:

1) Type RA-1: 3/4-inch nominal thickness resilient pipe sleeve between pipe and clamp or hanger.

a) Operating temperature at or below 80 degrees F, except in plenums: Armstrong Armaflex, Manville Aerotube or approved equal.
b) Operating temperature above 80 degrees F or in plenums: preformed glass fiber pipe insulation not exceeding 6 pcf.

2) Type RA-2: Manufactured insulated hanger for uninsulated pipe: Superstrut P/A-716 Cush-A-Clamp, Unistrut, B-line or approved equal.
3) Type RA-3: Manufacturer resilient attachment for water pipes 1 inch and less diameter: Technical Specialties Acousto-Plumb System (orange and blue).

f. Other Supports:

1) Type A: Pipe anchors, vertical or horizontal. Resilient anchor points in piping to preclude direct contact of piping with structure yet provide a neutral point for expansion/contraction or piping. Mason ADA.
2) Type T: Trapeze. Supporting sling of steel member with mount or hangers at each end. Used to distribute load or to conserve space.
3) Type S: Stanchion support. A supporting arm or system for equipment or piping between the isolator and load.
4) Type "cable" seismic restraints shall be constructed of 7 x 19 strand galvanized aircraft cable. Cable assembly shall come compete with two "U" bolt clamps per end. Allowed loads shall contain a safety factor of three when worse-case loading applied to one cable. Cable shall be installed with 1/4-inch slack to prevent the transmission of vibration to the structure.

g. Bases:

1) Type SF: Structural steel integral frame of wide flange (W) or junior beam (M) members. Rigid fabrication to preclude defections or frame distortion under dynamic load. Motor mounts, base plate mounts, stanchion support for piping or as shown on drawings for equipment, pumps, fans, etc. Brackets to prevent drop of frame more than 3/8 inch. Thickness minimum 8 percent longest dimension. Mason WFSL.
2) Type B: Brackets to equipment. Height saving brackets attached directly to equipment where rigidity of same does not require supplemental frame. Drop protection as for Type SF. Mason.

3) Type IB: Inertia base frame. Welded steel frame with rebar reinforcement and height saving brackets. Provision for air decoupling holes on large units. Unit delivered ready for assembly. Pour of concrete by General Contractor. Preset equipment mount attachment bolts or other hold down methods for equipment involved. Space between bottom of base and floor to be at least 2 inches. Minimum weight equal to one time weight of equipment or as selected by supplier. Thickness minimum 8 percent largest dimension. Mason KSL.

h. Pipe and Duct Seismic Supports:

1) Provide products with current OSHPD certification number or provide calculations demonstrating compliance with regulatory requirements.

i. Expansion Bolts: As specified in Section 055000.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Suspend the vibration isolators supporting piping ductwork and equipment from structural members.
2. Provide a minimum of 1 inch clearance between the building structure and vibration isolated supports, ducts, pipes, and equipment.
3. Provide 2 inches minimum clearance between the top of the housekeeping pad or floor and the underside of concrete inertial pads and/or steel equipment support frames.
4. Fasten all vibration isolators to the structure, not to floor diaphragms or lightweight components. Use bolts where holes are provided in the mounting flanges; otherwise, adhere using structural adhesive. Where mounting flanges are steel, use neoprene grommets and washers under anchor bolts.
5. Do not use vibration isolation components to straighten or connect misaligned sections of piping or ductwork.
6. Align spring isolation hanger rods to clear the hanger box under all operating conditions.
7. Any bracing or supports for mechanical ductwork, piping, and equipment shall not bridge or reduce the effectiveness of vibration isolators.
8. Level vibration isolated equipment under rated design operating conditions while maintaining the isolation criteria. Isolators shall be plumb and aligned to preclude misalignment or undesired contact during operation.

B. Equipment:

1. See mechanical equipment schedules (on drawings) for equipment isolation requirements.
2. Inertia base to weigh 1.0 times supported equipment.

C. Piping and Ductwork:

1. Support and brace all piping and ductwork as required in CBC.
2. Use trapezes for vertical support to horizontal piping only. Brace trapeze with an OSHPD pre-approved bracing system, or provide calculations demonstrating compliance with regulatory requirements.
3. Fire Protection Piping: Support and brace in accordance with NFPA Pamphlet 13. Piping 2-1/2 inches and larger and 12 inches or more below the attachment to the building structure shall be supported in accordance with NFPA 13 but shall be seismically braced.
4. No electrical conduit, fixture, ceiling suspension wires or other elements of the building construction attached to or abutted against the duct and piping systems.
5. Where duct and piping penetrate sound-isolation partitions, caulk the penetration airtight with Tremco Mfg. Co. acoustical sealant or equal. For indoors, provide non-toxic sealant approved for indoor use.
6. Contain rough-in of piping within stud wall cavities no less than 1/4-inch from the plane of the studs and 1 inch from gypsum board or other wall sheathing.
7. Install flexible connections at all connections to vibration isolated equipment, rotating, reciprocating and other vibrating equipment, all pumps, whether isolated or not and at all air handlers whether internally isolated or not.

D. Piping:

1. Vibration isolates all pipes except vents, gas and fire protection lines. Do not allow piping, plumbing or vent stacks to contact gypsum board.
2. Do not suspend plumbing or piping from ducts, conduits or related supports.
3. Isolate pipes less than 3 inches in diameter attached to prime movers, rotating and reciprocating equipment and pressure-reducing valves for a minimum of 100 feet from the inlet and discharge. Use Type NH isolators for vibration isolation hangers and Type NM for floor-supported mounts. Static deflection of 0.35 inches. Use Type NP resilient pads under pipe elbows supported from the floor. Where these pipes have resilient thermal insulation between the pipe and the pipe hanger, vibration isolators are not required.
4. Isolate domestic waterlines using Type RA-1 or RA-3 resilient attachments as appropriate.
5. Attach waste pipes and rain water leaders using resilient attachments in horizontal runs. Type NH. In vertical runs use Type NM underneath the supporting clamps. Use Type NP resilient pads under pipe elbows supported from the floor.
6. Isolate all other individual pipes using Type RA-1 resilient attachments in walls and Type RA-2 attachments for uninsulated pipe beneath slabs and above ceiling. Where the pipes have resilient thermal insulation between the pipe and pipe support, resilient attachments are not required.
7. Isolate all other grouped pipes by using Type NH vibration isolators supporting trapeze hangers. Static deflection of 0.35 inches. Isolate grouped floor-supported pipes using Type NM isolators having a static deflection of 0.35 inches. Where vertical orientation of the isolator attachment base is required, use "SNM" vibration isolator.
8. Provide flexible connectors in inlet and discharge piping systems for pumps having concrete inertial bases and where indicated on the Drawings.

E. Ductwork:

1. Support all ductwork within 30 feet of fans or air handlers on 0.30 inch Neoprene pads, except as noted in Item 2.
2. For equipment serving patient rooms on top floors and all systems other than low pressure, support all supply and return exhaust ductwork, including plenums with 0.20-inch deflection Type HD isolators.
3. Sheet metal band supports are not permitted on ducts suspended on vibration isolators. Use threaded rods, or other indicated support.
4. Do not suspend ducts from piping, plumbing, conduits or related supports.
5. Incorporate flexible connections in ductwork adjacent to all air moving units.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All piping and ductwork concealed or exposed shall have identification markers. All equipment and apparatus shall have identification markers.

B. Pipe marker shall comply with ANSI A13-1.

1.2 SUBMITTALS

A. Submit under provisions of General Conditions, Division 01, Section 013200 Construction Progress Documentation, Section 013300 Submittal Procedures, Section 016000 Product Requirements and Section 012500 Substitution Procedures as applicable.

B. Submit full size nameplate and tag samples. Samples will be returned after approval.

C. Refer to Section 230500 - Basic HVAC Requirements for start-up requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S IDENTIFICATION

A. Manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished under this specification. The nameplate of Subcontractor or Distributor is not acceptable.

B. Identify model number, size, capacity, electrical characteristics, serial number, etc.

C. Leave nameplates clean, legible and with unobstructed view.

2.2 APPARATUS IDENTIFICATION

A. Apparatus nameplates shall be 1 inch high; 1/16-inch thick, three layer black laminated plastic plates with 3/4-inch high white lettering engraved through the black layer. Four edge bevel. Confirm nameplate nomenclature with Owner's Representative.

B. Equipment identification shall be embossed aluminum or engraved plastic securely attached to each piece of equipment.

C. Secure nameplate to each starter, switch, relay, transformer, etc. that controls the equipment.

D. Nameplates to bear notations corresponding to notations on operating instructions and Drawings.

2.3 PIPE IDENTIFICATION

A. Identify with symbol identification and color-code all piping. Provide directional arrows on circulating systems separate from and adjacent to each identification. Identification shall conform to ANSI.1 Scheme of Identification of Piping Systems (OSHA).

B. Submit one 8-1/2 inch by 11 inch sample of each color for review prior to installation.

C. Plastic Markers: Brady Perma-Code or Setmark Type "SNA" self-adhesive markers. Each marker shall show accepted color-coded background, proper color of legend in relation to background color, accepted legend letter size, accepted marker length.

1. 2 inch letter size for pipe or insulation 3 inches or larger. 1 inch letter size for pipe or insulation 2-1/2 inches or smaller.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

E. Color Coding:

Service	A.S.A. Color Background	Color Of Letter
Chilled Water Return	Green	Black
Chilled Water Supply	Green	Black
Condenser Water Supply	Green	Black
Condenser Water Return	Green	Black
Domestic Cold Water	Green	Black
Domestic Hot Water Supply	Yellow	Black
Industrial & Soft Cold Water	Green	Black
Industrial Hot Water	Yellow	Black
Deionized Water	Green	Black
Electric Conduit	Gray	Black
Fire Alarm Conduit	Red	White
Fire Protection Water	Red	White
Heating Hot Water Return	Yellow	Black
Heating Hot Water Supply	Yellow	Black
High Pressure Steam	Yellow	Black
Steam Condensate	Yellow	Black
Medium and Low Pressure Steam	Yellow	Black
Medium and Low Pressure Condensate	Yellow	Black
Make-up Water	Green	Black
Natural Gas-G (LP)	Yellow	Black
Natural Gas (MPG)	Yellow	Black
Natural Gas Vent	Yellow	Black
Process Water Supply	Green	Black
Process Water Return	Green	Black
Sanitary Sewer	Green	Black
Sanitary Sewer Vent	Green	Black
Rainwater Leaders	Green	Black

Overflow Drain	Green	Black
Storm Sewer	Green	Black
Compressed Air (100)	Yellow	Black
Compressed Air (125)	Yellow	Black
Temperature Control Air	Green	Black
Oxygen	Green	White
Nitrous Oxide	Blue	White
Nitrogen	Black	White
Carbon Dioxide	Gray	Black
Medical Air	Yellow	Black
Medical Vacuum	White	Black
Soft Cold Water	Green	Black
Pan Drain	Green	Black
Secondary Drain (SD)	Green	Black
Condensate Drain (CD)	Yellow	Black
Medical Vacuum Exhaust	Yellow	Black
Compressor Air Intake	Yellow	Black

F. Paint exterior jacket of steam and steam condensate piping insulation per the requirements of Section 232213 23 Steam and Steam Condensate Piping prior to the application of identification decals. Painting shall be provided under Specification Section 099000 Painting and Coating.

G. Paint material gas piping red prior to application of identification decals. Painting shall be provided under Specification Section 099123 Interior Painting.

2.4 DUCTWORK IDENTIFICATION

A. Duct markers shall be Brady Perma-code or similar self-adhesive markers. Letters shall be 2 inches high. Identify all systems indicating contents (supply air, exhaust, isolation room exhaust, etc.) and direction of flow.

B. Locations: Identify ducts coming out of shafts, roof, and every 30 feet.

C.

Color Coding Service	Color Code
1. Supply Air	Blue
2. General Exhaust	Orange
3. Specialty Exhaust (isolation rooms)	Red

2.5 VALVE IDENTIFICATION

A. Attach to handwheel or stem of each control and line shutoff valve installed under this Division, with heavy brass "S" hook, color-coded plastic laminate or brass identification tag. Engrave laminate tags with 1 inch high designating numbers, in accordance with typed schedule showing valve sizes, locations, service, similar to following form:

DCW - 1-1/2 INCHES
SHUTOFF, OFFICE TOILETS
FIRST FLOOR
COLUMN J-4

B. Engrave identification tags with "normally open" (green) or "normally closed" (red).

C. Brass tags with stamped letters. Tag size minimum 1-1/2 inch diameter or square with smooth corners.

D. Identify all fire service valves with above specified tags with "FIRE MAIN - DO NOT CLOSE" with white letters on red background.

E. Identify medical gas and evacuation systems in Section 226313 Gas Piping for Laboratory and Healthcare Facilities, with metal or plastic identification plates with embossed black letters. Use colors as specified. Install valves in cabinets located where shown.

2.6 VALVE AND EQUIPMENT CHARTS

A. Provide five typewritten schedules giving numbers, service and locations, and notations of open or closed, of all tagged valves. Enclose each schedule in separate transparent plastic binder. List piping systems with symbol and color-coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines.

B. Submit drafts of valve schedule for review before preparing final sets.

C. Frame five copies of reviewed schedule under glass, mount where directed.

D. Provide typewritten list of equipment in triplicate, indicating location, service for each piece of equipment, suitably framed, with glass front.

2.7 CONTROLS

A. Provide engraved plastic laminate identification of function on switches and manually operable controls, including switches furnished under another Division 13 Special Construction and Division 26 Electrical.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials of any materials that will prevent paint to marker adhesion.

3.2 EQUIPMENT IDENTIFICATION

A. Equipment Identification:

1. Properly identify each piece of equipment and controls pertaining thereto by nameplates mounted on equipment and controls, includes terminal air box, controllers, fire/smoke dampers using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable. Similar to the following:

    a. TERMINAL AIR BOX: Room Number, Box Type and/or Size (3A125-VS1)
    b. FSD: FLOOR: FSD-Room Number or Grids.

B. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

C. Place warning signs on machines driven by electric motors that are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders.

D. Identify air handling units, fans and pumps with area served.

E. Small devices, such as inline pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify equipment out of view behind access doors, in unfinished rooms on the face of the access door.

3.3 IDENTIFICATION SCHEDULE

A. Refer to Section 099000 Painting and Coating.

3.4 DUCTWORK IDENTIFICATION

A. Provide identification of all toilet exhaust, general exhaust and supply air ducts by means of self-adhesive lettering identifying contents and direction of flow.

B. Colors: Black lettering on white background.

C. Locations: Provide identification of ducts coming out of shaft at each floor and in equipment rooms and at every 30 feet intervals

D. Isolation room exhaust air ducts shall be identified with labeling at intervals no more than 20 feet and at each story transversed by the exhaust system.

E. Application: Apply to clean surfaces free of dust, grease, oil or any other material which will prevent paint adhesion.

3.5 PIPING IDENTIFICATION

A. Apply markings after all cleaning and painting of piping and insulation is completed.

B. Secure each end of marker with 2-1/4 inch wide Brady self-sticking clear tape; wrap entire periphery.

C. Location for Pipe Identification:

1. Within one foot of each valve, fitting, thermometer or gauge (except on plumbing fixture).
2. At each branch and riser takeoff.
3. At each pipe passage through wall, floor and ceiling construction.
4. On all horizontal runs spaced 25 feet maximum but not less than once in each room at entrance and exit of each concealed space.
5. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.
6. At wall and ceiling access panels.
7. In addition to foregoing identification for piping, identify fire protection piping with one inch wide red painted band, completely encircling pipe adjacent to symbol identifications.
8. Practicable variations or changes in locations and spacing may be made with specific approval of the Owner's Representative to meet specific conditions.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. In finished areas, label exposed pipes or ducts only as directed by Owner's Representative.

3.6 VALVE IDENTIFICATION

A. Tag all valves except fixture stops.

B. Label plumbing valves "Plbg" plus valve identification number.

C. Label heating and air conditioning valves "Htg" plus valve number for heating water, steam, drains, etc. and "AC" plus valve number for chilled water, condenser water, etc. on cooling systems.

D. Number tags to conform to directory listing number, location and use.

E. Secure tags to valves with approved corrosion resistant brass "S" hooks.

3.7 CONCEALED IDENTIFICATION

A. Provide color-coded ceiling tacks to locate coils, fire dampers, valves, control devices, etc. or other approved label on each T-bar suspended ceiling push-out tile. Locate in corner of panel closest to equipment.

END OF SECTION 23055

SECTION 230593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide services and coordination required for a completely balanced, tested and certified air and water system. This includes reinstated sections of existing systems.

1. Provide services of an air-balance and testing agency whose business dedicated to the balancing, adjusting and testing of heating, ventilating, and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution systems, water systems, control systems or steam systems as specified and at end of each phase.
2. During warranty period, calibrate and adjust controls and re-balance areas as required to maintain satisfactory space requirements.
3. Complete and test all systems early enough to enable completion of balancing prior to owner move-in.
4. Independent agency certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

1.2 QUALITY ASSURANCE

A. Testing Agency (General and Mechanical Systems):

1. Qualifications: The balance and testing agency to provide proof of having successfully completed at least five projects of similar size and scope and to comply with all standards as set forth by the "Associated Air Balance Council" (AABC).
2. All Work by this agency shall be done under direct supervision of a qualified heating and ventilating engineer employed by them. All instruments used by this agency shall be accurately calibrated and maintained in good working order. Testing procedure to be as specified hereinafter. Conduct tests in the presence of the Owner's Representative.

B. Reference Standards:

1. General mechanical systems: Comply with applicable procedures and standards of "National Standards for Field Measurements and Instrumentation, Total System Balance" by the Associated Air Balance Council (AABC).
2. NEBB - National Environmental Balancing Bureau
3. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
4. ASHRAE - Handbook of Fundamentals

1.3 SUBMITTALS

A. Refer to Section 013300 for procedures.

B. Submit the name of selected Test and Balance agency for approval within thirty days after award of contract.

C. First Submittal:

1. Submit four copies of documentation to confirm compliance with quality assurance provisions:

    a. Organization, supervisor and personnel training, and qualifications, including registration of certified Test and Balance engineer.
    b. Specimen copy of each of the report forms proposed for use. Forms shall be equal to those shown in Chapter 27 of the "National Standards for the Total System Balance" of the Air Balance Council, 1989 Edition.
    c. General plan of testing procedures and sequences.
    d. General description of each air and water system with its associated equipment.
    e. List experience of similar type projects and references including Owner, Architect, Consulting Mechanical Engineer and Mechanical Contractor.

D. Second Submittal: With the initial mechanical Shop Drawing and at least 60 days prior to starting field work, submit three copies of:

1. A set of report forms filled out with the design flow values and equipment pressure drops, including required CFM for air terminals.
2. A complete list of instruments proposed to be used, organized in appropriate categories, with data sheets for each. Show:

    a. Manufacturer, model and serial number.
    b. Description and use when needed to further identify the instrument.
    c. Size or capacity range.
    d. Latest calibration date and certificates of calibration.

3. A detailed description of the balancing and testing procedures. These procedures shall conform to AABC requirements and recommendations.
4. Owner's Representative will review submittals for compliance with Contract Documents, and will return one set marked to indicate:

    a. Discrepancies noted between data shown and Contract Documents. Review is not intended to document all discrepancies.
    b. Additional or more accurate instruments required.
    c. Requests for re-calibration of specified instruments.
    d. Expansion of abbreviation of test procedures and sequences.

E. Third Submittal: The testing agency shall perform the tests described, compile the test data, and submit seven copies. Submittals shall be prepared in format acceptable to OSHPD and will include but not be limited to the following.

1. Complete test data typed in final form for forwarding to the Owner's Representative for approval.
2. Fan and pump curves with design and actual operation points plotted.
3. Written report as necessary describing any component, i.e. fan drive, damper, pumps, valve, etc. which does not function properly.

4. Legible key plans correlating with numeration of air devices hat correlates to air balance report tabulations.
5. Engineer of record review stamp approval.
6. Room pressurization tables indicating required pressure relationship and test validation.
7. Instrument calibration certificates validating recent calibration of instruments.
8. Report shall include report cover sheets that clearly identify building, systems, OSHPD project number, etc.
9. Preliminary reports are not acceptable.
10. Terminal air boxes including supply air boxes shall be numbered and identified in air balance reports to correlate with zone thermostat, i.e. 1B202-CV-5 (room number for thermostat- Box type and/or type). Coordinate numbering with other divisions.

1.4 JOB CONDITIONS

A. For existing conditions, obtain building as-built drawings from the Owner for pre-construction requirements.

B. Prior to start of testing, adjusting and balancing:

1. Systems installation to be complete and in full operation.
2. Outside conditions to be within 15 percent relative to design conditions.
3. Building lights shall be turned "on" when balancing cooling system, "off" when balancing heating system.
4. Special equipment such as computers, laboratory equipment, electronic equipment or engine generator to be in full operation.
5. Close all windows and doors.

C. Notification: Promptly report any deficiencies noted during performance of services. Rectify these deficiencies, and any tests interrupted shall be re-done.

PART 2 - PRODUCTS

A. Products and materials as described in Part 3 of this Section and related sections.

PART 3 - EXECUTION

3.1 PREBALANCING REQUIREMENTS

A. Advise Owner's Representative in writing when systems have been completed and tested and are ready for balancing.

B. Submit report on measured CFM, GPM, RPM, AMPS, inlet and outlet pressures of all equipment after testing and before balancing by Balancing Contractor.

C. Complete, perform and coordinate with other contractors the following Work prior to commencement of the balancing procedure.

1. Complete testing of systems.
2. Prior to the start of balancing, complete punch list items that will affect balancing of the system. Coordinate with Contractor to have all devices installed at no increase in contract sum.
3. Mechanical Contractor to install dampers and other balancing devices shown, specified, and required. Check to be sure they are properly installed, indexed, and in good working order.
4. Schedule the Work of other trades to eliminate system shutdown for any reason once balancing is started.
5. Schedule the Work of other trades to assure uninterrupted access to mechanical equipment rooms as well as conditioned spaces.
6. Provide labor and material necessary to perform any system revisions required to allow completion of balancing.
7. Lubricate all equipment in accordance with manufacturer's instructions.
8. Place systems in automatic operation.
9. Operate the systems for 72 consecutive hours without shutdown with equipment in perfect working order.
10. Check all motor starters to confirm heater size is correct. Take length of electrical feeder into consideration.
11. Air systems:

    a. Align drives.
    b. Set sheaves to provide indicated capacities at specified static pressures.
    c. Set manual dampers to 100 percent open position.
    d. Check all damper operations to ensure smooth, free activation by the proper controls.
    e. Remove adjustable pitch pulleys from motor shaft; clean and lightly oil shaft and pulley threads; and remount, align and properly adjust pulley.
    f. Drill 3/8-inch diameter holes in low velocity ductwork with burrs removed, for temperature, pressure and velocity readings; and provide holes in drive guards that will permit tachometer readings without removing guards. Locate as specified hereinafter and as directed. Install replaceable rubber plug in each hole.
    g. Clean interior of plenums, casing, coils and ducts; and install temporary and final filters before starting any systems.
    h. Drill test holes in the following locations: Each side of each filter, fan, coil and multi-blade damper; 12 inches on center for traverse readings in main ducts and as directed in the field. Turn at least ten extra plugs over to the Owner for use during balancing period.

12. Water systems:

    a. Set balancing cocks to 100 percent open position.
    b. Remove, clean and replace strainer screens, vent air from piping, verify proper operation of automatic air vents.
    c. Verify correct pump rotation.
    d. Position normally open valves full open.
    e. Examine water in system to determine if water has been treated and cleaned.

13. Existing systems:

a. When connecting to existing systems, verify existing air and water balance meets NEW quantities required in remodeled systems prior to construction. Notify Architect in writing of any discrepancies.
b. Test, balance and record existing air and water systems prior to commencing any work. Include the following:

1) Record air and water flows at each existing supply, return and exhaust air outlet, duct, terminal device and coil serving areas directly in this scope of work, and at each air outlet, duct, terminal device and coil that is outside the immediate scope of work but is connected to distribution systems of air handlers, fans, pumps, etc. that serve the remodeled areas.
2) Record air and water flows, inlet and outlet temperatures and pressures at existing air handlers, fans, pumps and other equipment that serve the affected areas.
3) Submit survey in typed form with final balance report.

c. Confirm extent of existing systems balance prior to bid.

3.2 INSPECTION

A. Review plans and specifications prior to installation of any of the affected systems. Prepare a schedule to inspect air and water systems and equipment. Submit written report with suggestions for work to be performed or devices added to allow for proper balancing. Added devices are at no increase in contract sum.

B. The Test and Balance Agency shall visit the jobsite a minimum of three times during the early stages of fabrication to inspect duct, pipe and equipment installation. Submit report to the Owner's Representative listing any deficiencies found that would preclude proper adjusting, balancing and testing.

C. Make field inspection prior to closing in portions of systems to be balanced. Verify that the Work, fittings, dampers, balancing devices, etc., are properly fabricated and installed as specified or shown and that proper balancing can be done.

3.3 INSTALLATION

A. Test Balance Service:

1. Perform analysis, test and balance services upon completion of air and water systems, after completion of general operating tests, Pre-balancing Requirements and after the Work specified above.

B. Performances and Capacity Checks:

1. Take readings as shown, specified and as required to demonstrate that all equipment, coils, terminal devices, controls, etc. are operating in accordance with scheduled or manufacturer's published ratings.
2. Recommend adjustments and/or corrections to equipment, air and water systems necessary for proper balancing. Submit report to Owner's Representative.

3. Provide each automatic control valve with a permanent brass tag stamped with the following information: valve model number, size and Cv.
4. Perform capacity checks of heating systems during the balancing period and again during a design day the following winter. Perform capacity checks for cooling systems during the balancing period and again during a design day the following summer.
5. Operating tests of heating and cooling coils, fans, pumps and other equipment to be of not less than four hours duration, after stabilized operating conditions have been established. Capacities to be based on temperatures, air and water quantities measured during such tests.

C. Existing Systems:

1. Balance new air and water flows in remodeled areas.
2. Re-balance entire existing air and water systems outside the remodeled areas to match pre-construction quantities recorded in the initial survey or as directed. This includes all air outlets, ducts, terminal devices and coils that are connected to equipment that serves the remodeled areas.
3. Re-balance existing air handlers, fans, pumps and other equipment to obtain new and restored air and water flows.
4. Replace filters at air handling units if, in the opinion of the Owner's facilities department or as indicated by filter gages, they are nearing the end of their useful life.
5. Pull and clean existing strainers.

3.4 AIR BALANCING

A. Adjust all air handling systems to provide the required design air quantity to, or through, each component. Keep doors and windows closed and all other ancillary systems in simultaneous operation. Balance under normal traffic conditions.

1. Balancing between runs (submains, branch mains and branches): Use flow regulating devices at, or in, the divided-flow fitting to the extent that adjustments do not create objectionable air motion or sound. Minimize restriction imposed by flow regulating devices, in, or at, terminals.
2. Final Measurements of Air Quantity: Make final measurements of air quantity, after the air terminal has been adjusted to provide the optimum air patterns of diffusion.

B. Air Measurements and Balancing:

1. Except as specifically indicated herein, make Pitot tube traverses to measure air flow. Pitot tubes, associated instruments, traverses and techniques to conform to the ASHRAE Handbook Fundamentals.
2. Pitot-tube traverse may be omitted if the duct serves only a single room or space and its design volume is less than 500 cfm. In lieu of Pitot-tube traverse, determine air flow in the duct by totaling volume of individual terminals served, measured as described herein.
3. Where duct's design velocity and air quantity are less than 800 (fpm/cfm), air quantity may be determined by measurements at terminals served.

4. Test holes, ventlock type, to be in a straight duct, as far as possible downstream from elbows, bends, take-offs and other turbulence generating devices, to optimize reliability of flow measurements.
5. Use measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, only for balancing. Determine measurement of air quantities at each type of air terminal (inlet and outlet) by the method approved.

C. Adjust air quantities to following tolerance:

1. Each outlet of 200 cfm or less: Minus 0 to plus 10 percent of design.
2. All other outlets: Minus 0 to plus 5 percent.
3. Each room with multiple outlets: Minus 0 to plus 5 percent.
4. Each floor or major zone: -0 to +10 percent of design.
5. Fans: -0 to +10 percent of design.
6. Temperature readings: Within 1/2-degree F.
7. Pressure readings: 0.02-inch W.G.
8. Under no circumstances can room pressure relationships change from that shown on drawings or required by code, even if within specified tolerances (i.e. equal room cannot become negative or positive, etc.)

D. Adjust control sequence, setting, and operation of automatically controlled dampers for normal operating conditions. Plainly mark final position of manual dampers after balancing is complete. Perform air-terminal readings in accordance with the recommendations of the air device manufacturer.

E. First utilize main dampers, then branch dampers. Use dampers behind grilles only as a final adjustment.

F. Make allowance for air filter resistance at time of tests. Main air supplies shall be at design air quantities and at air resistance across the filter bank midway between the design specifications for clean and dirty filters.

G. As part of balancing procedures, set fresh air and return air dampers to put the entire system into operating balance as shown and required.

H. Take duct and outlet readings with Anemotherms or Alnor velometers. Take readings on large air intakes, coil banks and filter banks with anemometer. Take static pressure readings with Dwyer U-tube manometer No. 400. Electrical current readings to be made with clamp-on type ammeter.

I. Provide positive identification points of measurements such as a marked print.

J. Tabulated fan capacity may exceed summation of register and diffuser readings. Leakage allowance as specified in Section 233113.

K. Mechanical Contractor provide additional dampers and pressure plates where required to facilitate balancing and to prevent damper, grille and diffuser noise. Provide at no increase in Contract Sum.

L. Check and adjust fan rpm to design requirements and record fan motor amperes.

M. Test, adjust and record system static pressures, suction and discharge ducts.

N. Test and adjust system for design, supply, recirculated, outside and exhaust air, cfm.

O. Use manufacturer's ratings on all equipment to make required calculations.

P. Adjust all diffusers and registers to eliminate drafts in all areas and result in uniform distribution.

Q. Verify leakage tests of all ductwork in accordance with paragraph titled, "Leakage Test" in Section 233113.

R. Make any adjustments to or change-out of the pulleys, belts, axial fan blade pitch and dampers, or the addition of dampers required for correct balance, as recommended by the Testing Agency, at no additional cost. RPM shown on drawings are for guidance only.

3.5 water balancing

A. Adjust all hydronic systems to provide required quantity to, or through, each component.

B. Initial Testing and Balance Procedure for Water Systems:

1. Balance hot water coils after balancing multiple coil sections for even water distribution through tubes.

C. Final Testing and Balance Procedure for Water Systems:

1. The testing agency shall perform the following test and adjustments upon completion of preparation and initial test:

a. After adjustments to coils and valves are made, recheck settings at the pumps and converters and readjust if required.
b. Read pressure drop through coils at set flow rate on call for full cooling or heating.
c. Adjust water quantities to the following tolerance:

1) Water flow: -5 to +5 percent of design.
2) Temperature: within 1/2-percent F.
3) Pressure: within 1/2-percent psi.

d. Measure water quantities and pressures with calibrated meters, if applicable:

1) Water measurements and balancing: Use venturi tubes, orifices or other metering fittings and pressure gages. Adjust systems to provide the approved pressure drops through the heat transfer equipment (coils, cooling towers, etc.), prior to the capacity testing.

2) Where flow metering fittings are not installed, determine flow balance by measuring temperature differential across the heat transfer equipment. Perform measurement of temperature differential with the air system, adjusted as described herein, in operation.

e. Position automatic control valves for full flow through heat transfer equipment of the system during tests.
f. Adjust flow through by-pass circuits at three-way valves to balance that through the supply circuit.
g. Adjust distribution by means of balancing devices (cocks, valves and fittings) and automatic flow control valves. Do not use service valves for adjustment. Where automatic flow control valves are utilized in lieu of venturi tubes, record only pressure drop across the valves if said pressure drop is within the pressure drop rating.
h. Special procedures: Where available pump capacity is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the systems.
i. Assure that all modulation control valves provide full throttling from wide open (design) flows to 100 percent shut-off. Verify control sequences, settings and operation to all automatic control valves.
j. Mechanical Contractor trim pump impellers to extent permitted to deliver the gpm equal to the lowest actual total systems head pressure.
k. Lock set points and plainly mark final position of all balance valves after balancing is complete. Read and record data.
l. Utilize thermometer wells, time-quantity devices and other line flow-measuring devices specified. In closed systems, where no line devices are installed, use a surface pyrometer probe.
m. Where pyrometers are used, tabulate surface temperature differentials between inlet and outlet of heat exchange devices. Pyrometers shall be Alnor Type 4200, scale 0-degrees to 500 degrees F, with a 2 degree F graduations and appropriate pipe probe.

3.6 BUILDING BAKEOUT

A. After installation of furniture, equipment, etc., operate air handling systems at 100 percent outside air with all thermostats at full heating continuously for 48 hours. At end of period, operate all air handling units and reset all thermostats under normal working conditions.

B. Submit data from temperature recorder documenting indoor temperatures over entire bakeout period.

3.7 OPERATION

A. After completion of balancing, operate all systems and equipment under normal working conditions for three consecutive 7-hour days. Submit record of performance.

3.8 VIBRATION TESTING

A. Assure vibration isolation system is operating properly.

B. Operate equipment and make audible and visual inspection to determine obvious rough operation. Mechanical Contractor shall correct these conditions before proceeding further.

C. Submit report to Architect.

3.9 TESTING PROCEDURE FOR SOUND LEVELS

A. Using recently calibrated instruments, conduct sound level tests in every room of the building. Measure sound level readings in decibels on the "A" and "C" scales of the General Radio Company sound level meter, or sound level meter that meets the current American Standard (Z34-3). Take sound level readings of the selected rooms or areas with the system in operation, as compared to total background sound level with the system not in operation.

B. Identify each outlet by room name, room number and air outlet number.

C. Measure sound levels in decibels at each diffuser, grille or register in areas designated and where directed. Measure sound levels approximately five feet above the floor on a line directly below the center of the diffuser, on the "A" and "C" scales of a General Radio Company sound level meter.

3.10 CONTROL SYSTEM TESTING PROCEDURE

A. Upon completion of the Building Control System completely check out and field test hardware and software to assure that the complete system performs in accordance with the approved sequences of operation. Test all equipment and control functions for proper automatic and manual activation. Test each system and zone for proper operation through its complete heating and cooling cycles.

B. Include the specific tests and control functions listed below:

1. Full point check.
2. Automatic activation of each smoke control strategy.
3. Manual activation of each fan and smoke damper.
4. System priorities and overrides.
5. Trouble monitoring and annunciation capability.
6. Power resumption response.
7. System failure response.
8. All user notification messages.

3.11 CERTIFIED REPORTS

A. Air System Data: Include for each air-handling system the data listed below:

1. Equipment (fan or factory fabricated station unit):

    a. Installation data:

        1) Identification number.
        2) Manufacturer and model.
        3) Size.
        4) Service.
        5) Arrangement, discharge and class.
        6) Motor hp, rated voltage, phase, cycles and rated full load amps.
        7) Full load amperes.
        8) Location and local identification data.

    b. Design data: Data listed in schedules on Drawings and Specifications or submittals.
    c. Fan recorded (test) data:

        1) CFM
        2) Static pressure: Suction, discharge, total.
        3) Fan rpm.
        4) Motor rpm.
        5) Motor sheave diameter: adjustable or solid.
        6) Fan sheave diameter.
        7) Outlet velocity.
        8) Motor operating amperes.
        9) Motor operating BHP.
        10) Actual voltage.

2. Duct system:

    a. Duct air quantities-Main, submains, branches, outside air, total supply air, return and exhaust:

        1) Duct size(s).
        2) Number of pitot tube (pressure) measurements.
        3) Sum of velocity measurement, excluding pressure measurements.
        4) Average velocity.
        5) Recorded (test) CFM and FPM.
        6) Design CFM and FPM.

    b. Individual air terminals:

        1) Terminal identification (supply, return or exhaust, location and number designation).
        2) Type, size, manufacturer and catalog identification.
        3) Design and recorded quantities-CFM.
        4) Deflector vane or diffusion cone settings.
        5) Applicable factor for application, velocity, area, etc.
        6) Design and recorded velocities-FPM (state "core", "inlet", etc., as applicable).

3. Filter and coil data as specified; scheduled on drawings or as required.

B. Room temperatures.

C. Water System Data:

1. Pumps:

a. Installation data:

1) Identification number.
2) Manufacturer and model.
3) Size.
4) Type drive.
5) Motor hp, voltage, phase and rated full load amperes.
6) Impeller size.

b. Design data:

1) GPM.
2) Total dynamic head.
3) RPM.
4) BHP and amperes.

c. Recorded data:

1) Discharge pressures (full-flow and no-flow).
2) Suction pressures (full-flow and no-flow)
3) Operating total dynamic head.
4) Operating GPM (from pump curves if metering is not provided).
5) No-load amperes (where possible).
6) Full-flow amperes.
7) No-flow amperes.
8) Elevation of each gauge above floor.

2. Flow devices including control valves:

a. Service.
b. Locations.
c. Size.
d. Required GPM.
e. Measured pressure difference.
f. Resultant actual GPM from venturi curves.

3. Air heating and cooling equipment including coils, and heat recovery coils:

a. Design data:

1) Load in BTUH and MBH.
2) GPM.
3) Entering and leaving water temperature.
4) Entering and leaving air conditions (DB and WB).
5) CFM.
6) Water pressure drop.

b. Recorded data:

1) Type of equipment and identification (location or number designation).
2) Entering and leaving air conditions (DB and WB).
3) Entering and leaving water temperatures.
4) GPM (if metered).
5) Temperature rise or drop.
6) Water and air pressure drop.

3.12 FINAL TESTS, INSPECTION AND ACCEPTANCE

A. General: Make tests to demonstrate that capacities and general performance of air and water systems comply with contract requirements. After the Test and Balance contractor has submitted records of final readings and measurements for all systems:

1. Final inspection: At the time of final inspection, spot-check, in the presence of the Owner's Representative, random selections of data, water and air quantities, air motion and sound levels recorded in the Certified Report.
2. Points and areas for spot-check: As selected by the Owner's Representative.
3. Measurement and test procedures: As approved for work forming basis of Certified Report.
4. Selections for spot-check (specific plus random): In general, selections for check will not exceed 25 percent of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.

B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 dB or greater than that recorded in the Certified Report listings, at 10 percent or more of the spot-checked selections, the report will be automatically rejected. In the event the report is rejected, readjust all systems concerned in the presence of the Owner's Representative. Test and record new data, submit new Certified Reports and make new inspection tests.

C. Marking of Settings: Following final acceptance of Certified Reports by the Architect, permanently mark the settings of all valves, splitters, dampers and other adjustment devices that are exposed to misuse, so that adjustment can be restored if disturbed at any time. Do not mark devices until after final acceptance.

END OF SECTION 230593

SECTION 230713 – HVAC DUCTWORK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide materials and accessories for installation of ductwork insulation as indicated on the Drawings and as specified.

1.2 SECTION INCLUDES

A. Ductwork insulation.

B. Insulation jackets.

1.3 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM E84 - Surface Burning Characteristics of Building Materials.

D. ASTM E96 - Water Vapor Transmission of Materials.

E. NFPA 255 - Surface Burning Characteristics of Building Materials.

F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

G. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of General Conditions and Division 01 as applicable.

B. Product Data: Provide product description, list of insulation, facing and jacket materials and thickness for each service, and locations, adhesive details and fastening devices, performance curves and thermal ratings.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 017823.

B. Manufacturer's Installation Instructions.

1.6 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of General Conditions and Division 01 as applicable.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, Mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fiber Glass and Acoustic Insulation

1. Owens Corning.
2. Certainteed.
3. Schuller.

B. Fire Rated Duct System

1. 3M Firemaster.
2. No known equal.

2.2 GLASS FIBER, FLEXIBLE DUCT WRAP (TYPE DW)

A. Insulation: ASTM C553 and C612; flexible, noncombustible blanket.

1. 'K' ('Ksi') value : ASTM C518, 0.29 at 75 degrees F.
2. Maximum service temperature: 350 degrees F.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 1.5 lb/cu ft.

B. Vapor Barrier Jacket - factory installed. (FSK)

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Tie Wire: Annealed steel, 16 gauge.

2.3 GLASS FIBER, RIGID duct wrap (TYPE rDW)

A. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' ('Ksi') value : ASTM C518, 0.23 at 75 degrees F
2. Maximum service temperature: 350 degrees F.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 3.0 lb/cu ft

B. Vapor Barrier Jacket - factory installed (FSK)

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.4 ACOUSTICAL DUCT LINING AND INSULATION BOARD(TYPE AL)

A. All acoustical duct lining shall incorporate means to prevent fiber entrainment in the air stream.

B. Acceptable product for lining rectangular section ducts and plenum: Certainteed "ToughGard" or approved equivalent.

C. Minimum sound-absorption coefficients (ASTM C423 Mounting Type A) for sound absorbing duct lining material:

	Octave Band Center Frequency (Hz.)					
	125	250	500	1000	2000	4000
1 inch thickness, 2.0 – 3.0 pcf density	.05	.25	.50	.70	.85	.85

D. Performance Parameters:

1. ASTM C423, Mounting Type A.
2. 'K'': ASTM C518, 0.23 at 75 degrees F.
3. Maximum service temperature: 250 degrees F (ASTM C411).
4. Maximum moisture absorption: 0.20 percent by volume.
5. Density: 1.5lb/cu.ft or 3lb/cu.ft as specified
6. Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, NFPA 90B, ASTM C665, ASTM G21 and G22 (fungi and bacteria resistant).
7. Greenguard or equal.
8. Rated velocity: 6000 fpm (ASTM C1071).
9. EPA recovered material compliance.

E. Internal duct liner acceptable only for exhaust air or outside air duct applications. Outside air applications only upstream of supply air filter.

2.5 JACKETS

A. Provide aluminum jacket system for outdoor ductwork with exterior insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Insulate all ducts as scheduled.

C. Install insulation where it cannot become wet. Wet insulation is not acceptable. Ensure insulation is dry before and during installation.

D. Internal duct lining shall be vacuumed and cleaned of all contaminants prior to and following erection. Obtain inspection certificate from Owner's Representative and/or Inspector of Record that each section is cleaned.

E. Butt insulation tightly at joints.

F. Duct Wrap - flexible fiberglass insulation (DW)

1. Provide insulation with vapor barrier jackets.
2. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
3. Secure insulation with 4 inch strips of adhesive at 8 inches on center, 2 inch lap strip at one end.
4. Install duct wrap to allow maximum fullness at corners. Avoid excessive compression. Minimum thickness at corners is 1 inch.
5. Lift ductwork off trapeze hangers and install spacers.
6. Seal lap strips with a foil vapor barrier tape or vapor barrier Mastic such as Foster Vapor Safe 30-80.
7. Where ducts are over 24 inches in width, additionally secure the duct wrap to the bottom of rectangular ducts with mechanical fasteners spaced on 12 inch centers to prevent sagging of insulation. Seal penetration of facing to provide a vapor-tight system with vapor barrier Mastic such as Foster Vapor Safe 30-80.
8. Continue insulation through walls, sleeves, hangers, and other duct penetrations. Pack around ducts with fireproof self-supporting insulation material and properly seal.

G. Duct Wrap - Rigid Fiberglass insulation (RDW).

1. Provide insulation with vapor barrier jackets.
2. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
3. Secure insulation with 4 inch strips of adhesive at 8 inches on center, 2 inch lap strip at one end.
4. Score insulation to cover standing seams.
5. Seal all joints and pin penetrations with pressure sensitive aluminum foil tape to provide a vapor-tight system. Provide vapor barrier Mastic, over tape to assure seal, Vapor Safe 30-80.
6. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers. Where ducts are over 24 inches in width, additionally secure the duct wrap to the bottom of rectangular ducts with mechanical fasteners spaced on 12 inch centers to prevent sagging of insulation. Seal penetration of facing to provide a vapor-tight system with vapor barrier Mastic such as Foster Vapor Safe 30-80.
7. Continue insulation through walls, sleeves, hangers, and other duct penetrations. Pack around ducts with fireproof self-supporting insulation material and properly seal.
8. Stop and edge seal insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct Liner (AL) – Allowed only on exhaust and return ductwork were specifically specified or shown, and supply ducts in non-patient areas.

1. Provide insulation.
2. Insulate all portions of duct scheduled or noted to receive duct liner.
3. Neatly butt transverse joints with no interruptions or gaps.
4. Cut duct liner to assure overlapped end compressed longitudinal corner joints.

5. Apply with 100 percent coverage of Foster's 85-20 (solvent based) or Foster 85-60 (water-based) adhesive. Use Tuffweld nylon pins or gripnail fasteners at 12 inches on center but not less than one pin on each surface of duct.
6. Ensure that insulation is mounted with correct side of duct liner to air stream. Ensure that surface adjacent to air flow, including at joints, is uniformly flat.
7. Seal butt joints with Foster 40-10 and exposed edges of liner to prevent erosion. Tape all seams and joints with 40-10 and reinforcing where duct is large enough for access to joints.
8. At access openings and doors in ducts and plenums, along edges exposed to air flow and at leading edges in rectangular ducts provide 24 gauge sheet metal Z sections framed over the edge of the insulation.

I. Fasteners:

1. Where pins or anchors are required above secure insulation to ductwork in accordance with following minimum requirements.

   a. Weld pins and adhered anchors at minimum 12 inch centers.
   b. Maximum permissible load:

      1) 5 lb. for 2 inch x 2 inch baseplate
      2) 10lb for 2-3/4 inch x 2-3/4 inch baseplate.

   c. Clip off pin penetrations flush with insulation surface or facing.
   d. Seal pins and washers with 2 inch x 2 inch square pieces of vapor barrier material to match facing. Adhere with vaporseal adhesive.

J. Butt insulation tightly at joints.

K. Finish insulation neatly at hangers, supports and other protrusions

L. .Locate insulation or cover seams in least visible locations.

M. Where ducts cannot be insulated after erection insulate prior to erection.

N. Finish with ducts at operating conditions.

O. Where specified thickness of insulation exceeds available thickness in a single layer provide insulation in 2 or more layers with joints staggered.

3.3 DUCTWORK INSULATION SCHEDULE

A. Provide insulation as scheduled or as required to meet T-24 requirements. The more stringent of the two will be required.

System	Location	Insulation	Thickness	Acoustic *	Finish
Supply Air	Concealed within building	DW 1-1/2 lbs./ cu.ft.	1-1/2"	—	Vapor barrier FSK/wire
Supply Air	Out of doors	RDW 3.0 lbs/cu.ft	2"	_	Aluminum jacket System
Supply Air	Mech. Area,	RDW 3.0	2"	_	Aluminum

System	Location	Insulation	Thickness	Acoustic *	Finish
	Shafts	lbs/cu.ft			jacket System **
Return Air	Out of doors	AL.	2"	2"	Vapor barrier FSK/wire
Return Air to Air Handling Units	Mech. Area, Shafts	RDW 3.0 lbs./cu.ft.	2"	—	Aluminum jacket system
Exhaust/ Return Air	Exposed in conditioned spaces	None	—	—	—
Return Air And Exhaust Air	Concealed in conditioned spaces	None	1"	—	—

* Noise Reduction Coefficient: ASTM C423. Omit acoustic liner on vapor, hood, and isolation rooms exhaust ducts.
** In mechanical area, provide aluminum jacket system. Aluminum duct wrap not required at shafts.

3.4 NET DIMENSIONS

A. Where acoustical liner is indicated on the Drawings, the duct sizes indicated on the Drawings shall be clear inside dimensions.

END OF SECTION 230713

SECTION 230719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide materials and accessories for installation of mechanical insulation to piping systems as indicated on the drawings and as specified.

1.2 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.3 REFERENCES

A. Commercial and Industrial Insulation Standards, published by Western Insulation Contractors Association (WICA, latest edition).

B. California Code of Regulations - Title 24, Part 2, Chapters 2-53.

C. California Building Code, Table 2-53E, California Electric Code, NFPA, and UL.

D. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

F. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

G. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe.

H. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

I. ASTM E84 - Surface Burning Characteristics of Building Materials.

J. ASTM E96 - Water Vapor Transmission of Materials.

K. NFPA 255 - Surface Burning Characteristics of Building Materials.

L. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of General Conditions and Division 1 as applicable.

B. Product Data: Provide product description, list of materials, thickness for each service, performance curves and thermal ratings.

C. Submit the following: insulation materials; jackets and facing materials, adhesives, fastening devices and vapor barrier.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of General Conditions and Division 1 as applicable.

B. Owner's Manual: Manufacturer's Installation Instructions.

1.6 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.

B. Flame proofing treatment subject to deterioration due to moisture or humidity is not acceptable.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing the Work of this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of General Conditions and Division 1 as applicable.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 MANUFACTURERS

A. Insulation

1. Owens Corning.
2. Certainteed.
3. Schuller.
4. Armstrong.

B. PVC Jackets

1. Schuller.
2. Speedline.

PART 2 - PRODUCTS

2.1 GLASS FIBER

A. Insulation: ASTM C547; rigid molded, noncombustible.

1. 'K' ('ksi') value : ASTM C335, 0.23 at 75 degrees F.
2. Minimum Service Temperature: -20 degrees F.
3. Maximum Service Temperature: 450 degrees F.
4. Maximum Moisture Absorption: 0.2 percent by volume.

2.2 CALCIUM SILICATE

A. Insulation ASTM C533.

1. K value 0.42 at 200 degrees F.
2. Maximum service temperature 1200 degrees F.
3. Density 15 pcf.
4. Waterproofed.
5. Flexural Strength 100 psi.

2.3 ELASTOMERIC TUBING

A. Insulation ASTM C534.

1. K value - 0.28 at 75 degrees F.
2. Maximum service temperature 220 degrees F.
3. Density 6.0 pcf.
4. Closed cell form. Vapor permeability ASTM E96 0.2 perm.
5. Max moisture absorption: 1.0 percent by volume, 10 percent by weight.

B. Seal with Rubatex adhesive.

2.4 POLYISOCYANURATE INSULATION

A. Insulation ASTM C591, Dow Trymer 9501.

1. Polyisocyanurate rigid foam insulation.
2. K value 0.14 at 75 degrees F.
3. Service temperatures: +300 degrees F to -320 degrees F.
4. Density: 2.0 pcf.
5. Closed cell form. Water absorption 0.05 lbs./ft^2.

2.5 CELLULAR GLASS INSULATION

A. Insulation ASTM C552, Corning Foamglas.

1. Rigid cellular glass pre-formed insulation.
2. K value 0.33 at 75 degrees F
3. Service temperatures: +900 degrees F to -320 degrees F.
4. Density: 8.5 pcf.
5. Closed cell form. Water absorption 0.2 percent by volume.
6. Vapor Permeability 0.0 perm/inch.

2.6 JACKETS

A. Factory Applied Vapor Barrier Jacket (ASJ).

1. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
3. Secure with self sealing longitudinal laps and butt strips.
4. Secure vapor barrier mastic.
5. Tie Wire: 16 gauge stainless steel with twisted ends on maximum 12 inch centers.
6. Vapor Barrier Lap Adhesive: Compatible with insulation.

B. PVC Plastic

1. Jacket: ASTM C921. One piece molded type fitting covers and sheet material, off white color.

    a. Minimum Service Temperature: -40 degrees F.
    b. Maximum Service Temperature: 150 degrees F.
    c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
    d. Maximum Flame Spread: ASTM E84; 25.
    e. Maximum Smoke Developed: ASTM E84; 50.
    f. Thickness: 20 mil
    g. Connections: Brush on welding adhesive, Tacks or Pressure sensitive color matching vinyl tape.

2. Covering Adhesive Mastic: Compatible with insulation.

C. Canvas Jacket: UL listed.

1. Fabric: ASTM C921, 6 oz/sq. yd, plain weave cotton treated with dilute fire retardant lagging adhesive.
2. Lagging Adhesive: Compatible with insulation.

D. Aluminum Jacket: ASTM B209.

1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.

E. Steel Jacket

1. Thickness: - 0.01 inch sheet.
2. Finish:

2.7 PRE-INSULATED PIPE SUPPORT AND SHIELDS

A. Insulated pipe supports shall be supplied and installed by the Mechanical Contractor on all insulated pipe and tubing. Insulated pipe supports shall be manufactured by Pipe Shields, Inc.

B. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.

C. All insulated pipe supports shall have calcium silicate insulation and galvanized steel jackets. Pipe supports for use on flat surfaces shall have integral load distribution plates coated with zinc primer minimum 3 mils thick.

D. Approved Insulated Pipe Supports

1. Pipe supported on rod hangers - use Models A1000, A2000, A3000, 4000 and A9000.
2. Pipe supported on flat surfaces - use Models A1000, A2000, A5000, A6000, A7000, A7200 and A7400 Series.
3. Pipe supported on pipe rolls - use Models A3000, A4000, A5000, A6000, A8000, A8200 and A8400 Series.
4. Model designations are by Pipe Shields, Inc. Use only models designed for service for which supports are to be used.

E. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density calcium silicate compressive strength 600 psi. Guide slide pads shall be Teflon. Contractor shall ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000. Anchors shall be Pipe Shields, Inc. Model #C4000. All steam and condensate pipework supports shall be provided with guides.

F. Hangers and supports shall fit outside of all pipe insulation and insulation inserts. Provide pre-insulated pipe supports as specified and install per manufacturer's installation instructions. Shield lengths and gauges shall also be per manufacturer's recommendations.

G. Tape all butt joints where pipe insulation butts up against hanger shield.

1. On hot pipe, apply three inch wide vapor barrier tape or band over the butt joint.
2. On chilled water piping, apply wet coat vapor barrier lap cement on all butt joints and seal the joints with a minimum of three inch wide vapor tape or band.

2.8 PENETRATIONS THROUGH RATED WALLS

A. Refer to drawings. Commercial pipe sleeve assemblies which are UL rated and which have been approved by the fire marshal for this purpose shall be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Insulate all piping, valves, fittings, flanges and accessories.

C. On exposed piping, locate insulation and cover seams in least visible locations.

D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fitting covers or radial mitered segments of pipe insulation. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

F. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping.

G. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations.

H. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

I. Fiber Glass Insulation:

1. Provide insulation with factory applied vapor barrier jackets.
2. Butt edges neatly. ASJ with 3 inch minimum butt strips.
3. Longitudinal overlaps: Minimum 2 inch self sealing, double adhesive.
4. Apply additional jacket as specified.
5. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive.

J. Calcium Silicate Insulation

1. Provide insulation without vapor barrier.
2. Secure insulation sections with minimum 16 gauge wire.
3. Build up coating of insulating and finishing cement.
4. Provide calcium silicate rings between flange sleeve and pipe insulation.
5. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive.
6. Apply additional jacket as specified. If no additional jacket specified apply skim coat of finishing cement to smooth out surface of fitting insulation.

K. Elastomeric Tubing

1. Provide insulation.
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations
3. Apply additional jacket as specified.

L. Polyisocyanurate Insulation

1. Provide insulation.
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations
3. Apply coating in accordance with manufacturer's recommendations.
4. Apply additional jacket as specified.

M. Foamed Glass Insulation

1. Provide insulation.
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive in accordance with insulation manufacturer's recommendations.
3. Secure insulation using metal bands or fiber-reinforced tape in accordance with manufacturer's recommendations for service temperature.
4. Apply weather barrier mastic or metal jacket as specified.

N. For all pipe systems exposed in the mechanical equipment rooms, finish with white PVC jacket.

O. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

P. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 SCHEDULES

A. Pipe Insulation Schedule. Provide insulation as scheduled or as required to meet T-24 requirements. The more stringent of the two will be required.

B. Insulation Thickness for Nominal Pipe Sizes:

System	Pipe 1" and less O.D.	Pipe 1-1/4" to 2" O.D.	Pipe 2-1/2" to 4" O.D.	Pipe larger than 5" O.D.	Notes
Any pressure hot water 200ºF and less. Indoors.	1-1/2" 1/2" on final runouts less than 12'	1-1/2"	2"	2"	Fiberglass or Elastomeric
Any pressure hot water 200ºF and less. Outdoors.	1-1/2"	1-1/2"	2"	2"	Elastomeric
Chilled water 40ºF-75ºF. Indoors.	1"	1"	1-1/2"	1-1/2"	Fiberglass or Elastomeric
Low pressure steam to 15 psig steam condensate and drain. Hot water 200ºF -250ºF. Indoors.	1-1/2"	1-1/2"	2"	3-1/2"	Fiberglass or calcium silicate*

System	Pipe 1" and less O.D.	Pipe 1-1/4" to 2" O.D.	Pipe 2-1/2" to 4" O.D.	Pipe larger than 5" O.D.	Notes
Low pressure steam to 15 psig. Steam Condensate steam vents and drain. Hot water 200ºF -250ºF. Outdoors.	2"	2"	2"	3-1/2"	Fiberglass**
Horizontal condensate drains in building or plenum	1/2"	1/2"	1/2"	1/2"	Elastomeric or Fiberglass
Medium and high pressure steam. Hot water 251ºF-350ºF. Indoors***	2" 1-1/2" on final runouts less than 12'	2-1/2"	2-1/2"	3-1/2"	Fiberglass or calcium silicate*
Medium and high pressure steam. Hot water 251ºF-350ºF. Outdoors.	2"	2-1/2"	2-1/2"	3-1/2"	Fiberglass**
Refrigerant. Indoors and Outdoors.	1"	1"	1"	1"	Elastomeric or fiberglass
MRI cryogen vent pipe insulation	1"	1"	1"	1"	Flexible insulation

* Steam systems in riser, calcium silicate or provide aluminum jacketing.
** Provide aluminum jacketing
*** Safety relief vent insulation inside risers: 1" insulation.

C. Pipe, Valve And Fitting Cover Schedule:

System	Location	Jacket
Condensate Drain	Concealed in unconditioned spaces	ASJ*
Chilled Water	Outdoors	Aluminum
Chilled Water, Hot Water, Steam and Steam Condensate, including Steam Vents	Mechanical Rooms (including Penthouse)	Aluminum
Chilled Water, Hot Water, Steam and Steam Condensate, including Steam Vents	Concealed within building.	ASJ*

* ASJ is All Service Jacket. See Section 2.

END OF SECTION 230719

SECTION 230800 – COMMISSIONING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes provisions for commissioning of HVAC, plumbing and fire protection systems.

1.2 SUBMITTALS

A. Coordinate and comply with provisions of Section 013300 – Submittal Procedures.

B. Submit a Commissioning Plan describing extent of field tests and procedures and proposed testing schedule. Submit, along with the Commissioning Plan, commissioning checklists to be used on the project. Submit final Commissioning Plan based on Architect/Owner review of initial Commissioning Plan. Submit final commissioning checklists based on Architect/Owner review of initial commissioning checklists and results of commissioning work.

C. Submit a Training Plan describing extent of plan, expected duration of training, personnel involved, and schedule at least 30 days prior to start of formal maintenance training sessions.

D. Tool List: Identify tools, equipment on which tools are used, reason tools required, source, price, and delivery.

1.3 QUALITY ASSURANCE

A. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE): ASHRAE Guideline 1-1989, Guidelines for Commissioning of HVAC system.

B. SMACNA: HVAC Systems Commissioning Manual.

C. NEBB: Procedural Standards for Building Systems Commissioning.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SYSTEMS COMMISSIONING REQUIREMENTS

A. General: The Contractor shall assure all building systems are commissioned. Commissioning shall include all requirements noted in Section 019113 – General Commissioning Requirements and as described hereinafter. Sample checklists have been included at the end of this Section (3.2 - Commissioning Checklists) to serve as a reference for the detail expected from the Contractor's Checklists.

B. Follow ASHRAE Guideline 1-1989, SMACNA HVAC Systems Commissioning Manual and NEBB Procedural Standards for Building Systems Commissioning as guidelines for commissioning process.

C. Acoustic Commissioning:

1. Refer to Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment for acoustic requirements.

D. HVAC Commissioning:

1. HVAC commissioning shall begin after HVAC equipment and systems, along with related equipment, systems, structures, and areas are complete. Refer to Section 234800 – Vibration and Seismic Controls for HVAC Piping and Equipment for acoustic requirements.
2. Verify TAB readings and other equipment testing such as supply, return, relief, exhaust, and outside air; fan performance; hydronic system performance; branch duct readings; sound level readings; etc. See Section 230593 - Testing, Adjusting and Balancing for HVAC.
3. Verify calibration of thermostats and related controls, such as terminal boxes, damper settings, valve positions, etc.
4. Verify calibration of humidity sensors, humidistats and related controls, such as in-duct humidifiers steam and hydronic valve positions, etc.
5. Verify readings of remote data and control systems, such as: temperature, room pressures, airflow, damper positions, water pressures, water temperatures, etc
6. Verify operation of system modes, such as economizer cycle, heat recovery mode, smoke removal mode, (stair) pressurization mode and specifically runaround loop valve operation, damper and fan operation, smoke detector response, zone response, etc.
7. Verify that total HVAC system is performing to provide operation at design conditions, specifically part and full load conditions. Verify temperature, humidity air volume flow rates, air velocity, air quality, zone control, energy management, pressurization, smoke control, control response etc.
8. Commission the following systems and any other system included in the Contract Documents that render this a fully functional building.

a. Chilled Water Systems including:

1) CHW Distribution System(s)

b. Pipe, valves, gauges, sensors, meters, etc

1) Vibration isolation system(s)
2) Chemical treatment systems
3) Other related systems or items

c. Hot Water Systems including:

1) HHW Distribution System(s)

d. Pipe, valves, gauges, sensors, meters, etc

1) Chemical treatment systems
2) Vibration isolation system(s)
3) Other related systems or items.

e. Steam Systems including:

1) Steam Pressure Reducing Valves
2) Steam Distribution System(s)

f. Pipe, valves, gauges, sensors, meters, etc

1) Steam Humidifiers and associated pipe, valves, fittings, etc.
2) Steam Separators
3) Condensate Drains
4) Steam Specialties
5) Vibration isolation system(s)
6) Other related systems or items.

E. Plumbing Commissioning:

1. Plumbing commissioning shall begin after plumbing equipment and systems, along with related equipment, systems, structures, and areas are complete. Refer to Section 234800 – Seismic Controls for HVAC Piping and Equipment for acoustic requirements.
2. Verify readings, such as:

a. Water temperatures and pressures
b. Vacuum, medical air, nitrous oxide and nitrogen system pressures
c. Test length of time until faucet delivers hot water

3. Verify calibration of thermostats, pressure gauges, and related controls on equipment such as:

a. Domestic hot water generators (heaters)
b. Vacuum pumps and air compressors
c. Domestic water boosters

4. Verify readings of remote data and control systems, such as water temperatures and pressures.
5. Verify that total plumbing system is performing correctly.
6. Commission the following systems and any other system included in the Contract Documents that render this a fully functional building.

    a. Plumbing Systems

        1) Sanitary waste and roof drain.
        2) Piping systems such as domestic cold water, domestic hot water, natural gas.
        3) Vibration isolation system(s)
        4) Other related systems or items.

    b. Hot Water Heat Exchangers
    c. Underground Tanks
    d. Water Softening Systems
    e. Boiler Feed Systems
    f. Steam Humidifier ICW supply Systems
    g. Plumbing Fixtures and Trim
    h. Medical Air System, including:

        1) Compressors, motors, starters and/or drives
        2) Air distribution system(s)
        3) Vibration isolation system(s)
        4) Other related systems or items.

    i. Medical Vacuum System, including:

        1) Compressors, motors, starters and/or drives
        2) Air distribution system(s)
        3) Vibration isolation system(s)
        4) Other related systems or items.

    j. Domestic Water System, including:

        1) DHW Pumps, motors, starters and/or drives
        2) DHW Distribution System(s)

            a) Pipe, valves, gauges, sensors, meters, etc

        3) Other related systems or items.

F. Fire Protection System Commissioning

1. Fire protection system commissioning shall begin after fire protection system equipment and systems, along with related equipment, systems, structures and areas are complete.
2. Verify fire pump operation and capacity (discharge pressure and water flow rate at full capacity and shutoff head).
3. Verify fire water system alarm transmission as outlined in the design intent.

G. Building Automation System

1. See Section 230923 – Instrumentation and Controls for HVAC

3.2 COMMISSIONING CHECKLISTS

A. The following pages of Commissioning Checklists do not represent the Work of this project. They are examples for the Contractor to use in developing project-specific checklists.

B. Example: Commissioning Checklist – Air Handling System

COMMISSIONING CHECKLISTS

AIR HANDLING SYSTEM
TEST PERFORMED BY:_____DATE:_____
TEST WITNESSED/REVIEWED BY: DATE:

☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	OPTIMUM START - TREND REVIEW ACTION: PRINT AND ATTACH TREND GRAPHS FOR AIR HANDLER, INCLUDING THE FOLLOWING POINTS: OUTSIDE AIR ENTHALPY, OUTSIDE AIR TEMPERATURE, SPACE TEMPERATURE, RETURN AIR TEMPERATURE, SUPPLY/RETURN FAN STATUS, OUTSIDE AIR DAMPER COMMAND, HEATING VALVE COMMAND, COOLING VALVE COMMAND. EXPECTED RESULTS: FANS START PRIOR TO SCHEDULED OCCUPANCY TIME. SPACE (OR RETURN AIR) TEMPERATURE RISES TO OCCUPIED HEATING SET POINT, OR FALLS TO OCCUPIED COOLING SET POINT, CLOSE TO SCHEDULED OCCUPANCY TIME. OUTSIDE AIR DAMPER REMAINS CLOSED (UNLESS CONDITIONS ALLOW COOLING OR NIGHT PURGE) UNTIL SCHEDULED OCCUPANCY TIME.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	STEADY STATE STATUS ACTION: OBSERVE SYSTEM IN OPERATION BEFORE MAKING ANY CHANGES. EXPECTED RESULTS: ZONE CONTROLS, (IF CONTROLLED BY PRIMARY CONTROLLER) MAINTAIN SPACE TEMPERATURE SET POINTS. HEATING VALVE AND COOLING VALVE MODULATE TO MAINTAIN APPLICABLE SET POINTS. IF APPLICABLE, DISCHARGE SET POINTS ARE RESET BY TERMINAL EQUIPMENT. IF OUTSIDE AIR CONDITIONS PERMIT, ECONOMIZER DAMPERS MODULATE TO MAINTAIN APPLICABLE TEMPERATURE SET POINT. OTHERWISE, DAMPERS MODULATE TO MAINTAIN AIR QUALITY SET POINT, OR ARE AT MINIMUM OUTSIDE AIR POSITIONS. IF VAV FANS MODULATE TO MAINTAIN DUCT PRESSURE/VOLUME SET POINTS. HUMIDIFIER MODULATES TO MAINTAIN SET POINT.
	STANDALONE MODE

☐ **PASS** ☐ **FAIL** ☐ **N/A**	ACTION: WITH SYSTEM OPERATING NORMALLY IN OCCUPIED MODE, DISCONNECT COMMUNICATIONS CABLES. EXPECTED RESULTS: FANS CONTINUE TO OPERATE NORMALLY. HEATING VALVE, COOLING VALVE AND HUMIDIFIER MODULATE TO MAINTAIN SET POINTS. IF SET POINT IS NORMALLY RESET BY TERMINAL CONTROLLER ACTION, CONFIRM THAT AN APPROPRIATE DEFAULT VALUE IS USED FOR FAIL MODE. DAMPERS MODULATE TO MAINTAIN AIR QUALITY SET POINT, OR ARE AT MINIMUM OUTSIDE AIR POSITIONS. LOSS OF COMMUNICATION ALARM IS RECEIVED, AND LAN RECONFIGURATION STATUS IS REPORTED AT THE APPROPRIATE WORKSTATION
REMARKS:	
	LAN RECONFIGURATION
☐ **PASS** ☐ **FAIL** ☐ **N/A**	ACTION: RECONNECT COMMUNICATIONS CABLES TO PANEL TERMINATIONS. EXPECTED RESULTS: LAN RECONFIGURATION STATUS IS REPORTED AT THE APPROPRIATE WORKSTATION. DDC PANEL AUTOMATICALLY RESUMES LAN COMMUNICATIONS, AND CHANGES TO NON-STANDALONE MODE.
REMARKS:	
	OFF STATUS
☐ **PASS** ☐ **FAIL** ☐ **N/A**	ACTION: WITH SYSTEM INITIALLY ON, INITIATE A STOP COMMAND FROM THE DDC CONTROLLER. EXPECTED RESULTS: SUPPLY FAN AND RETURN FAN STOP, INTERLOCKED EXHAUST FANS STOP AND EXHAUST DAMPER CLOSES, OUTSIDE AIR DAMPER CLOSES, RELIEF DAMPER CLOSES, SMOKE DAMPERS CLOSE, HUMIDIFIER VALVE CLOSES, HEATING VALVE OPENS, AND CHILLED WATER VALVE CLOSES.
REMARKS:	
	FAN START
☐ **PASS** ☐ **FAIL** ☐ **N/A**	ACTION: WITH SYSTEM INITIALLY OFF, INITIATE A START COMMAND FROM THE DDC PANEL. EXPECTED RESULTS: DUCT SMOKE DAMPERS OPEN, IF ANY EXIST. SUPPLY FAN STARTS. RETURN FAN (IF ANY) STARTS AFTER PROGRAMMED TIME DELAY. IF VAV, FANS RAMP UP TO SPEED WITHOUT OVERSHOOT. INTERLOCKED EXHAUST FANS START AND EXHAUST DAMPER OPENS. OUTSIDE AIR DAMPER OPENS TO MINIMUM POSITION OR GREATER.
REMARKS:	
	RESTART AFTER POWER FAILURE
☐ **PASS** ☐ **FAIL** ☐ **N/A**	ACTION: TRIP POWER BREAKER THAT SERVES DDC PANEL. RESTORE POWER. IF SYSTEM IS ON EMERGENCY POWER, SKIP TO NEXT TEST. EXPECTED RESULTS: PANEL CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS AND ENTERS CORRECT OPERATIONAL MODE.

REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	EMERGENCY POWER ACTION: TRIP MAIN NORMAL POWER FEEDER. EXPECTED RESULTS: EMERGENCY POWER GENERATOR STARTS. PANEL CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS, AIR HANDLING UNITS START WITH APPLICABLE TIME DELAYS, AND CONTROLS ENTER CORRECT OPERATIONAL MODE. RETURN TO NORMAL POWER FOLLOWING TEST.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	FAN FAILURE ALARM ACTION: WITH SYSTEM INITIALLY ON, SIMULATE A FAN FAILURE BY PLACING MOTOR STARTER HOA SWITCH IN "OFF" POSITION. EXPECTED RESULTS: SUPPLY AND RETURN FANS STOP, HEATING VALVE OPENS, FAN FAILURE ALARMS ARE REPORTED, OUTDOOR AND EXHAUST AIR DAMPERS CLOSE.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	FREEZESTAT ACTION: WITH SYSTEM INITIALLY ON, MANUALLY TRIP FREEZE STAT TO SIMULATE A FREEZE CONDITION. EXPECTED RESULTS: SUPPLY AND RETURN FANS STOP, HEATING VALVE OPENS, FAN FAILURE ALARMS ARE REPORTED, OUTDOOR AND EXHAUST AIR DAMPERS CLOSE, A FREEZE ALARM IS REPORTED AT THE WORKSTATION.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	SMOKE DETECTORS ACTION: WITH SYSTEM INITIALLY ON, MANUALLY TRIP EACH SMOKE DETECTOR TO SIMULATE A FIRE CONDITION. RECORD LENGTH OF TIME BETWEEN TRIP AND ENUNCIATION AT PRIMARY OPERATOR INTERFACE. EXPECTED RESULTS: SUPPLY AND RETURN FANS STOP, OUTDOOR AND EXHAUST AIR DAMPERS CLOSE, SMOKE DAMPER(S) CLOSE, FAN FAILURE ALARMS ARE REPORTED, A FIRE ALARM IS REPORTED AT THE WORKSTATION.
☐ **PASS** ☐ **FAIL** ☐ **N/A**	UNOCCUPIED MODE - NO CONDITIONING REQUIRED ACTION: CHANGE OCCUPANCY SCHEDULE AT WORKSTATION IF NECESSARY TO PLACE SYSTEM IN UNOCCUPIED MODE. EXPECTED RESULTS: SUPPLY FAN AND RETURN FAN STOP, OUTSIDE AIR

REMARKS:	DAMPER CLOSES.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	UNOCCUPIED MODE - HEATING REQUIRED ACTION: WITH SYSTEM IN UNOCCUPIED MODE, OVERRIDE ONE SPACE TEMPERATURE INPUT TO A FALSE READING OF 53 DEGREES F. EXPECTED RESULTS: SUPPLY FAN AND RETURN FANS START, OUTSIDE AIR DAMPER REMAINS CLOSED, AND HEATING VALVE MODULATES TO MAINTAIN DISCHARGE SETPOINT OR PREHEAT SETPOINT AS APPLICABLE.
☐ **PASS** ☐ **FAIL** ☐ **N/A**	UNOCCUPIED MODE - COOLING REQUIRED ACTION: WITH SYSTEM IN UNOCCUPIED MODE, OVERRIDE ONE SPACE TEMPERATURE INPUT TO A FALSE READING OF 92 DEGREES F. EXPECTED RESULTS: SUPPLY FAN AND RETURN FANS START, AND COOLING COIL VALVE MODULATES TO MAINTAIN DISCHARGE SETPOINT. IF CONDITIONS PERMIT, ECONOMIZER DAMPERS ALSO MODULATE IN SEQUENCE WITH COOLING COIL VALVE TO MAINTAIN DISCHARGE SETPOINT MINUS 2 DEGREES F.
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	UNOCCUPIED MODE - ZONE OVERRIDE REQUEST ACTION: WITH SYSTEM IN UNOCCUPIED MODE, USE PRESS A ZONE OVERRIDE SWITCH. EXPECTED RESULTS: SUPPLY FAN AND RETURN FANS START, CONTROLS FOR OCCUPIED MODE.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	NIGHT PURGE CYCLE ACTION: ENABLE NIGHT PURGE CYCLE AND CHANGE OCCUPANCY SCHEDULE AT WORKSTATION IF NECESSARY TO PLACE SYSTEM IN UNOCCUPIED MODE. OVERRIDE OUTSIDE AIR TEMPERATURE INPUT VALUE TO 1 DEGREE F BELOW SPECIFIED TRIP POINT. LOWER SPECIFIED OCCUPIED SPACE TEMPERATURE SETPOINT IF NECESSARY TO MAKE IT LESS THAN APPLICABLE SPACE TEMPERATURE OR OVERRIDE SPACE TEMPERATURE VALUE TO GREATER THAN SPECIFIED SPACE TEMPERATURE TRIP POINT (SEE SEQUENCE). OVERRIDE CALCULATED OUTSIDE AIR ENTHALPY VALUE IF NECESSARY TO MAKE IT LESS THAN 24 BTU/LB. EXPECTED RESULTS: SUPPLY FAN AND RETURN FANS START, OUTSIDE AIR DAMPER OPENS FULLY, HEATING AND COOLING VALVES REMAIN CLOSED. IF APPLICABLE, ZONE CONTROLS CHANGE TO OCCUPIED SETPOINTS.

☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	ECONOMIZER ON ACTION: CHECK IF OUTSIDE ENTHALPY IS LESS THAN 28 BTU/LB AND OUTSIDE AIR TEMPERATURE IS AT LEAST 1 DEGREE F BELOW RETURN AIR TEMPERATURE. IF OUTSIDE ENTHALPY IS GREATER THAN 28 BTU/LB OR OUTSIDE AIR TEMPERATURE IS AT LEAST 1 DEGREE F ABOVE RETURN AIR TEMPERATURE, THEN PERFORM "ECONOMIZER OFF" TEST FIRST, THEN RETURN TO THIS TEST AND OVERRIDE OUTSIDE AIR TEMPERATURE INPUT TO A FALSE READING OF 2 DEGREES F LESS THAN RETURN AIR TEMPERATURE. EXPECTED RESULTS: OUTSIDE AIR DAMPER MODULATES TO MAINTAIN COOLING SET POINT 2 DEGREES F BELOW COOLING VALVE SET POINT.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	ECONOMIZER STEP RESPONSE TEST ACTION: RECORD (MIXED AIR OR DISCHARGE AIR) SET POINT. RAISE (MIXED AIR OR DISCHARGE AIR) SET POINT 5°F. RECORD CONTROLLED TEMPERATURE AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED TEMPERATURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT: _____ VALUE AFTER 5 MINUTES:
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	ECONOMIZER OFF ACTION: CHECK IF OUTSIDE ENTHALPY IS GREATER THAN 28 BTU/LB OR OUTSIDE AIR TEMPERATURE IS AT LEAST 1 DEGREE F ABOVE RETURN AIR TEMPERATURE. IF NOT, OVERRIDE OUTSIDE AIR TEMPERATURE INPUT TO A FALSE READING OF 2 DEGREES F GREATER THAN RETURN AIR TEMPERATURE. EXPECTED RESULTS: OUTSIDE AIR DAMPER REMAINS CLOSED OR AT MINIMUM POSITION.
☐ **PASS** ☐ **FAIL** ☐ **N/A**	COOLING COIL STEP RESPONSE TEST ACTION: RECORD DISCHARGE AIR TEMPERATURE SET POINT. RAISE DISCHARGE AIR SET POINT 5 DEGREES F. RECORD CONTROLLED TEMPERATURE AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED TEMPERATURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. IF OUTSIDE CONDITIONS ALLOW, ECONOMIZER MODULATES TO 100 PERCENT BEFORE COOLING COIL BEGINS TO OPEN. INITIAL SETPOINT: INITIAL VALUE: CHANGED SETPOINT: VALUE AFTER 5 MINUTES:

REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	HEATING COIL STEP RESPONSE TEST ACTION: RECORD DISCHARGE AIR TEMPERATURE SET POINT. LOWER DISCHARGE AIR SET POINT 5 DEGREES F. RECORD CONTROLLED TEMPERATURE AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED TEMPERATURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: INITIAL VALUE: CHANGED SETPOINT: VALUE AFTER 5 MINUTES:
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	VAV DUCT PRESSURE STEP RESPONSE TEST ACTION: RECORD DUCT PRESSURE SET POINT. LOWER SET POINT 0.5-INCH W.G. RECORD CONTROLLED DUCT PRESSURE AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED DUCT PRESSURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: INITIAL VALUE: CHANGED SETPOINT: VALUE AFTER 5 MINUTES:
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	VAV HIGH DISCHARGE PRESSURE LIMIT ACTION: OVERRIDE DISCHARGE PRESSURE VALUE TO 0.5-INCH W.G. ABOVE SPECIFIED HIGH LIMIT SET POINT. EXPECTED RESULTS: FAN SPEED BACKS DOWN. [A HIGH DISCHARGE PRESSURE ALARM IS REPORTED.
☐ **PASS** ☐ **FAIL** ☐ **N/A**	VAV RETURN FAN TRACKING - TREND REVIEW ACTION: PRINT AND ATTACH TREND GRAPHS OF AIR HANDLER INCLUDING THE FOLLOWING POINTS: SUPPLY FAN VOLUME, RETURN FAN VOLUME, SUPPLY FAN SPEED COMMAND, RETURN FAN SPEED COMMAND, DUCT PRESSURE. EXPECTED RESULTS: RETURN FAN VOLUME TRACKS SUPPLY FAN VOLUME AT VOLUME DIFFERENTIAL SET POINT DURING OCCUPIED MODE. RETURN

REMARKS:	FAN VOLUME EQUALS SUPPLY FAN VOLUME DURING UNOCCUPIED, WARM-UP, AND COOL-DOWN MODES
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	HIGH HUMIDITY LIMIT ACTION: OVERRIDE DISCHARGE HUMIDITY VALUE TO 95 PERCENT. EXPECTED RESULTS: HUMIDIFIER VALVE MODULATES CLOSED. AFTER 5 MINUTES, TWO POSITION STEAM SUPPLY SHUTOFF VALVE CLOSES AND A HIGH HUMIDITY ALARM IS REPORTED.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	ENERGY WASTE ALARM ACTION: OVERRIDE HEATING VALVE OUTPUT TO OPEN VALVE WHILE COOLING COIL IS MAINTAINING DISCHARGE TEMPERATURE. TEMPORARILY OVERRIDE ALARM DELAY TO 1 MINUTE. EXPECTED RESULTS: AN ENERGY WASTE ALARM IS REPORTED AT THE APPLICABLE WORKSTATION. INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT: _____ VALUE AFTER 5 MINUTES:

C. Example: Commissioning Checklist – Chilled Water System

COMMISSIONING CHECKLISTS

CHILLED WATER SYSTEM
TEST PERFORMED BY:_____**DATE:**_____
TEST WITNESSED/REVIEWED BY:_____**DATE:**_____

☐ **PASS** ☐ **FAIL** ☐ **N/A**	STEADY STATE STATUS ACTION: OBSERVE SYSTEM IN OPERATION BEFORE MAKING ANY CHANGES. EXPECTED RESULTS: IF ALL AIR HANDLING UNIT CHILLED WATER VALVES ARE OPEN TO LESS THAN 10 PERCENT [AND IF LESS THAN 4 FAN-COILS ARE CALLING FOR COOLING], OR CAMPUS LOOP PUMPS ARE NOT OPERATING, THEN COOLING SYSTEM IS DISABLED, CHILLED WATER PUMP IS OFF, AND BUILDING VALVE IS CLOSED. IF ANY AIR HANDLING UNIT CHILLED WATER VALVE IS OPEN TO MORE THAN 75 PERCENT[OR IF AT LEAST 4 FAN-COILS ARE CALLING FOR COOLING], AND CAMPUS LOOP PUMPS ARE OPERATING, THEN COOLING SYSTEM IS ENABLED AND OPERATES AS FOLLOWS: CHILLED WATER PUMP SPEED MODULATES TO MAINTAIN RDP SET POINT. RDP SET POINT IS RESET ACCORDING TO MOST OPEN VALVE. BUILDING VALVE

	MODULATES TO MAINTAIN BUILDING CHILLED WATER SUPPLY TEMPERATURE SET POINT. SET POINT IS RESET BY BUILDING DIFFERENTIAL TEMPERATURE (BDT).
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	COOLING SYSTEM DISABLE ACTION: OVERRIDE ALL AIR HANDLING UNIT COOLING VALVE OUTPUTS TO 10 PERCENT OPEN OR LESS [, AND OVERRIDE ALL EXCEPT 3 FAN-COIL COOLING REQUESTS]. EXPECTED RESULTS: CHILLED WATER PUMP IS OFF, BUILDING VALVE IS CLOSED.
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	COOLING SYSTEM ENABLE - PUMP CYCLE ALARM ACTION: WITHIN 10 MINUTES OF STOPPING PUMP, OVERRIDE ONE AIR HANDLING UNIT VALVE OPEN TO 80 PERCENT. EXPECTED RESULTS: PUMP STARTS. PUMP SPEED MODULATES TO MAINTAIN RDP SET POINT. RDP SET POINT RESETS ACCORDING TO MOST OPEN VALVE. BUILDING VALVE MODULATES TO MAINTAIN BUILDING CHILLED WATER SUPPLY TEMPERATURE SET POINT. A PUMP CYCLE ALARM IS REPORTED TO THE APPROPRIATE WORKSTATION.
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	PUMP SPEED STEP RESPONSE TEST ACTION: RECORD RDP SET POINT. OVERRIDE SET POINT DOWN 5 PSI. RECORD CONTROLLED RDP AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED RDP SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT: _____ VALUE AFTER 5 MINUTES:
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	BUILDING CHWS SET POINT RESET - BUILDING VALVE STEP RESPONSE TEST ACTION: OVERRIDE BUILDING RETURN WATER TEMPERATURE VALUE TO A HIGHER VALUE. EXPECTED RESULTS: BUILDING CHILLED WATER SUPPLY TEMPERATURE SET POINT RESETS ACCORDINGLY. CONTROLLED CHILLED WATER SUPPLY TEMPERATURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN

REMARKS:	UNDER 5 MINUTES. INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT _____ VALUE AFTER 5 MINUTES:
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	REVERSE BYPASS FLOW ALARM ACTION: OVERRIDE LOOP RETURN TEMPERATURE VALUE TO 3 DEGREES F BELOW BUILDING RETURN TEMPERATURE. EXPECTED RESULTS: A REVERSE BYPASS FLOW ALARM IS REPORTED TO THE APPROPRIATE WORKSTATION.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	PUMP FAILURE ALARM - STANDBY PUMP START ACTION: WITH SYSTEM INITIALLY ON, SIMULATE A LEAD PUMP FAILURE BY PLACING MOTOR STARTER HOA SWITCH IN "OFF" POSITION. EXPECTED RESULTS: LEAD PUMP FAILURE ALARM IS REPORTED, STANDBY PUMP STARTS AND SPEED MODULATES TO MAINTAIN RDP SET POINT.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	RESTART AFTER POWER FAILURE ACTION: TRIP POWER BREAKER THAT SERVES DDC PANEL. RESTORE POWER. IF SYSTEM IS ON EMERGENCY POWER, SKIP TO NEXT TEST. EXPECTED RESULTS: PANEL CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS AND ENTERS CORRECT OPERATIONAL MODE.
☐ **PASS** ☐ **FAIL** ☐ **N/A**	EMERGENCY POWER ACTION: TRIP MAIN NORMAL POWER FEEDER. EXPECTED RESULTS: EMERGENCY POWER GENERATOR STARTS. PANEL CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS, AND CONTROLS ENTER CORRECT OPERATIONAL MODE. RETURN TO NORMAL POWER FOLLOWING TEST.
REMARKS:	

D. Example: Commissioning Checklist – Heating Water System

COMMISSIONING CHECKLISTS

HEATING WATER SYSTEM
TEST PERFORMED BY:_____**DATE:**_____

TEST WITNESSED/REVIEWED BY:_____DATE:_____

☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	STEADY STATE STATUS ACTION: OBSERVE SYSTEM IN OPERATION BEFORE MAKING ANY CHANGES. EXPECTED RESULTS: IF ALL AIR HANDLING UNIT HEATING VALVES ARE OPEN TO LESS THAN 10 PERCENT, AND IF LESS THAN 4 FAN-COILS ARE CALLING FOR HEATING THEN HEATING WATER PUMP IS OFF, AND STEAM CONVERTER VALVES ARE CLOSED. IF ANY AIR HANDLING UNIT HEATING VALVE IS OPEN TO MORE THAN 75 PERCENT, OR AT LEAST 4 FAN-COILS ARE CALLING FOR HEATING, THEN HEATING SYSTEM IS ENABLED AND OPERATES AS FOLLOWS: HEATING WATER PUMP SPEED MODULATES TO MAINTAIN RDP SET POINT. RDP SET POINT IS RESET ACCORDING TO MOST OPEN VALVE. CONVERTER STEAM VALVES MODULATE TO MAINTAIN HEATING WATER SUPPLY TEMPERATURE SET POINT. SET POINT IS RESET BY PUMP SPEED.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	HEATING SYSTEM DISABLE ACTION: OVERRIDE ALL AIR HANDLING UNIT HEATING VALVE OUTPUTS TO 10 PERCENT OPEN OR LESS[,AND OVERRIDE ALL EXCEPT 3 FAN-COIL COOLING REQUESTS]. EXPECTED RESULTS: HEATING WATER PUMP IS OFF, CONVERTER STEAM VALVES ARE CLOSED.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	HEATING SYSTEM ENABLE - PUMP CYCLE ALARM ACTION: WITHIN 10 MINUTES OF STOPPING PUMP, OVERRIDE ONE AIR HANDLING UNIT HEATING VALVE OPEN TO 80 PERCENT. EXPECTED RESULTS: PUMP STARTS. PUMP SPEED MODULATES TO MAINTAIN RDP SET POINT. RDP SET POINT RESETS ACCORDING TO MOST OPEN HEATING VALVE. CONVERTER VALVES MODULATE TO MAINTAIN HEATING WATER SUPPLY TEMPERATURE SET POINT. SET POINT IS RESET BY PUMP SPEED. A PUMP CYCLE ALARM IS REPORTED TO THE APPROPRIATE WORKSTATION.
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	PUMP SPEED STEP RESPONSE TEST ACTION: RECORD RDP SET POINT. OVERRIDE SET POINT DOWN 1 PSI. RECORD CONTROLLED RDP AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED RDP SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT: _____ VALUE AFTER 5 MINUTES:

☐ **PASS** ☐ **FAIL** ☐ **N/A**	CONVERTER STEP RESPONSE TEST ACTION: RECORD HOT WATER SUPPLY TEMPERATURE SET POINT. CHANGE SET POINT 10 DEGREES F. RECORD CONTROLLED TEMPERATURE AFTER 5 MINUTES. EXPECTED RESULTS: CONTROLLED TEMPERATURE SETTLES OUT WITHIN SPECIFIED CONTROL TOLERANCE IN UNDER 5 MINUTES. INITIAL SETPOINT: INITIAL VALUE: CHANGED SETPOINT: VALUE AFTER 5 MINUTES:
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	HEATING REQUEST ALARM ACTION: WITH DUAL TEMPERATURE SYSTEM IN HEATING MODE, OVERRIDE OUTSIDE AIR TEMPERATURE VALUE UP TO 66 DEGREES F. EXPECTED RESULTS: A WARM WEATHER HEATING REQUEST ALARM IS REPORTED AT THE APPLICABLE WORKSTATION. INITIAL SETPOINT: INITIAL VALUE: CHANGED SETPOINT: VALUE AFTER 5 MINUTES:
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A**	PUMP FAILURE ALARM - STANDBY PUMP START ACTION: WITH SYSTEM INITIALLY ON, SIMULATE A LEAD PUMP FAILURE BY PLACING MOTOR STARTER HOA SWITCH IN "OFF" POSITION. EXPECTED RESULTS: LEAD PUMP FAILURE ALARM IS REPORTED, STANDBY PUMP STARTS AND SPEED MODULATES TO MAINTAIN RDP SET POINT.
REMARKS:	
☐ **PASS** ☐ **FAIL** ☐ **N/A** **REMARKS:**	RESTART AFTER POWER FAILURE ACTION: TRIP POWER BREAKER THAT SERVES DDC PANEL. RESTORE POWER. IF SYSTEM IS ON EMERGENCY POWER, SKIP TO NEXT TEST. EXPECTED RESULTS: PANEL CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS AND ENTERS CORRECT OPERATIONAL MODE.
☐ **PASS** ☐ **FAIL**	EMERGENCY POWER ACTION: TRIP MAIN NORMAL POWER FEEDER. EXPECTED RESULTS: EMERGENCY POWER GENERATOR STARTS. PANEL

☐ **N/A**	CLOCK KEEPS CORRECT TIME/DATE. PROGRAM RESTARTS, AND CONTROLS ENTER CORRECT OPERATIONAL MODE. RETURN TO NORMAL POWER FOLLOWING TEST.
	INITIAL SETPOINT: _____ INITIAL VALUE: _____ CHANGED SETPOINT: _____ VALUE AFTER 5 MINUTES: _____
REMARKS:	

END OF SECTION 230800

SECTION 230900 – TEMPERATURE CONTROL AND ENERGY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplemental Conditions and Division 1 General Requirements.

1.2 SCOPE OF WORK

A. Interface new devices to existing building automation system (BAS).

B. Complete temperature control system to be DDC as specified herein.

C. Supply and install all instrumentation specified in the sequence of operations and/or control diagrams required for a complete and operating system.

D. All wiring, conduit, panels, tubing for all DDC temperature controls.

E. Installation of air flow control system, air flow volume measuring stations and static pressure probes.

1.3 RELATED WORK

A. Division 1 - General and Special Conditions.

B. Division 23 - All Mechanical Sections.

C. Division 26 - All Electrical Sections.

1.4 SUBMITTALS

A. Submit complete sets of documentation before starting any work.

B. Engineering Submittals are to consist of the following (at a minimum):

1. Product Information on all proposed hardware items.
2. Valve Schedules with Cv, Sizes, Model, Body Type.
3. System Architecture Diagram showing integration to existing BAS.
4. System Zone Architecture Diagram showing all zone controllers, network wiring and power wiring.
5. Wiring Details (interlocks, relays, etc.) for all systems as required.
6. Detailed Control Diagrams of each system controlled. Diagrams are to include all I/O, Point Names, Interlocks and tubing required to meet the sequence of operations.

7. Instrument Index that lists for every physical point on the project, the point name, the point address, alarm parameters and instrumentation.

C. All Engineering Drawings are to be created in AutoCAD 2005and soft-copy of all AutoCAD files are to be provided to The Owner's Representative as part of O&M Manuals. Drawings created in "VISIO" and/or other CAD programs are not acceptable. The AutoCAD drawings will indicate the exact location of all control devises with a clear code so that the device can be traced to a controller and sequence of operation.

D. Provide copies of submittals as described in division 1.

E. The As-Builts of the above submittals, plus the checkout procedures and detailed owner manuals for outside materials shall constitute the O&M Manuals.

1.5 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after The Owner's Representative's acceptance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. To match existing installation.

2.2 BMS DESCRIPTION

A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. Any and all components of the BMS that are connected via field bus or IP network, including the network controllers, field controllers, application specific controllers, server and user interface software, system and controller programming tools and software applications shall be designed, engineered, and tested to work together as a complete building management system, and shall be manufactured by the same BMS manufacturer. Systems that use or require network controllers, field controllers, application specific controllers, server and user interface software, programming tools and software from more than one BMS manufacturer shall not be accepted.

C. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface will be a standard Web Browser accessible from any computer, laptop, smart phone or tablet.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

F. Integrate new control system with the existing BMS. Update the main campus server with new graphics, floor plans, trends, logs, and alarms.

2.3 QUALTIY ASSURANCE

A. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems. Independent controls contractors are not acceptable.

B. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.

C. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. The BMS Contractor shall have at this facility at least eight (8) factory trained, directly employed and full time technical staff, spare parts inventory, and all necessary test and diagnostic equipment.

D. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.

2.4 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions. All devices and equipment shall be approved for installation by the Authorities having jurisdiction.

B. Room Temperature Sensors

1. Temperature monitoring range +30/120°F
2. Output signal Changing resistance
3. Accuracy at Calibration point +0.2°F
4. Room sensors shall be constructed for either surface or wall box mounting.
5. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:

    a. Display room air temperatures.
    b. Display and adjust room comfort setpoint.
    c. Display and adjust fan operation status.
    d. Timed override request push button with LED status for activation of after-hours operation.
    e. Display controller mode.
    f. Password selectable adjustment of setpoint and override modes.

C. Duct (single point) temperature:

1. Temperature monitoring range +20/120°F (-7°/49°C)
2. Output signal Changing resistance
3. Accuracy at Calibration point +0.2°F
4. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
5. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
6. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

D. Humidity Sensors:

1. The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealtite fittings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
7. Acceptable Manufacturers: Johnson Controls and Vaisala.

E. Control Valves (all control valves shall have electric/electronic actuators).

1. Electric Control

2.	Rangeability	40:1
3.	Flow Characteristics	Modified. Equal percentage
4.	Control Action	Normal open or closed as selected
5.	Medium	Steam, water, glycol
6.	Body Type	Screwed ends 2" and smaller, flanged
7.	Valves	2-1/2" and larger
8.	Body Material	Bronze
9.	Body Trim	Bronze
10.	Stem	Stainless Steel
11.	Actuator	0-10 VDC, 4-20 MA or 2 position 24VAC/120VAC

12. All automatic temperature control valves in water lines shall be provided with characterized throttling plugs and shall be sized to achieve a minimum authority of 0.5 for 3-way valves and an authority between 0.3 and 0.5 for two way valves.

F. Thermo wells

1. Thermowell manufacturer shall have models available in stainless steel, brass body, and copper bulb.
2. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.
3. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
4. Thermo wells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
5. Thermo wells constructed of 316 stainless steel shall comply with Canadian Registration Number (CRN) pressure vessel rating.

G. CO2 Sensors

1. Where shown on the drawings, C02 sensors shall have the following features:

   a. Jumper selectable: 0-20mA, 4-20mA & 0-10VDC output
   b. Liquid Crystal Display

2. The C02 sensors shall have the ability to monitor and output the following variables as required by the systems sequence of operations:

   a. Zone carbon-dioxide

3. The C02 shall transmit the information back to the controller via jumper selectable 0-20mA, 4-20mA & 0-10VDC output signals.

   a. The C02 sensors shall provide a maximum output current of 25mA; Maximum output voltage of 12.5V.
   b. The C02 sensors shall be FCC compliant to CFR47 Part 15 subpart B Class A.

4. The C02 Sensors shall be available with

   a. CO2 response time (0-63%) of 1 minute
   b. Less than 0.083% of full scale/F˚ temperature dependence of CO2 output
   c. Long term CO2 stability 5% of full scale for 5 years

d. CO2 measurement accuracy of (40ppm + 2.0% of reading)
e. CO2 non-linearity of less than 1.0% of full scale

5. The C02 Sensors may include the following items :

a. Relay output module
b. Liquid Crystal Display module
c. Analog temperature module with linear 0-10VDC output for 32-122F

H. Outside Air Sensors

1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
2. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
3. Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures.
4. The outdoor sensor can be easily mounted on a roof, pole or side of a building utilizing its already assembled mounting bracket.
5. Outside Relative Humidity sensors 0-100% full range of accurate measurement. Operating temperature -4 to 140F (-20 to 60C).
6. Outside temperature sensors operating temperature range is -40 to 140F, +/- .55F (+/- .3C).

I. Network automation Engines

1. Network Automation Engine (NAE 55XX)

a. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
b. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
c. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

1) The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
2) The NAE shall support up a minimum of four (4) concurrent users.
3) The web based user shall have the capability to access all system data through one NAE.
4) Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
5) Systems that require the user to address more than one NAE to access all system information are not acceptable.
6) The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.

7) Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
8) The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:

   a) Configuration
   b) Commissioning
   c) Data Archiving
   d) Monitoring
   e) Commanding
   f) System Diagnostics

9) Systems that require workstation software or modified web browsers are not acceptable.
10) The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.

d. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
e. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
f. Hardware Real Time Clock – The NAE shall include an integrated, hardware-based, real-time clock.
g. The NAE shall include troubleshooting LED indicators to identify the following conditions:

   1) Power - On/Off
   2) Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
   3) Ethernet Connection Speed – 10 Mbps/100 Mbps/1000 Mbps
   4) FC Bus A – Normal Communications/No Field Communications
   5) FC Bus B – Normal Communications/No Field Communications
   6) Peer Communication – Data Traffic between NAE Devices
   7) Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running
   8) Bat Fault – Battery Defective, Data Protection Battery Not Installed
   9) 24 VAC – 24 VAC Present/Loss Of 24VAC
   10) Fault – General Fault
   11) Modem RX – NAE Modem Receiving Data
   12) Modem TX – NAE Modem Transmitting Data

h. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.

   1) Two (2) USB port
   2) Two (2) URS-232 serial data communication port
   3) Two (2) RS-485 port

4) One (1) Ethernet port

i. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

j. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

1) During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
2) Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

k. Certification – The NAE shall be listed by Underwriters Laboratories (UL).

l. Controller network – The NAE shall support the following communication protocols on the controller network:

1) The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
2) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
3) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
4) A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
5) The Conformance Statements shall be submitted 10 days prior to bidding.
6) The NAE shall support a minimum of 100 control devices.

J. Field equipment Controllers

1. Advanced Application Field Equipment Controller (FAC 261X)

a. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.

1) The FAC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.

a) The FAC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
b) The FAC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
c) A BACnet Protocol Implementation Conformance Statement shall be provided for the FAC.

d) The Conformance Statement shall be submitted 10 days prior to bidding.

b. The FAC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

c. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FAC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

d. The FAC shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:

1) Schedules
2) Calendars
3) Alarms
4) Trends

e. The FAC can continue time-based monitoring when offline for extended periods of time from a Metasys system network.

f. The FAC can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the field controllers.

g. The FAC shall include troubleshooting LED indicators to identify the following conditions:

1) Power On
2) Power Off
3) Download or Startup in progress, not ready for normal operation
4) No Faults
5) Device Fault
6) Field Controller Bus - Normal Data Transmission
7) Field Controller Bus - No Data Transmission
8) Field Controller Bus - No Communication
9) Sensor-Actuator Bus - Normal Data Transmission
10) Sensor-Actuator Bus - No Data Transmission
11) Sensor-Actuator Bus - No Communication

h. The FAC shall accommodate the direct wiring of analog and binary I/O field points.

i. The FAC shall support the following types of inputs and outputs:

1) Universal Inputs - shall be configured to monitor any of the following:

a) Analog Input, Voltage Mode
b) Analog Input, Current Mode
c) Analog Input, Resistive Mode

d) Binary Input, Dry Contact Maintained Mode
e) Binary Input, Pulse Counter Mode

2) Binary Inputs - shall be configured to monitor either of the following:

a) Dry Contact Maintained Mode
b) Pulse Counter Mode

3) Analog Outputs - shall be configured to output either of the following

a) Analog Output, Voltage Mode
b) Analog Output, Current Mode

4) Binary Outputs - shall output the following:

a) Line-voltage relay outputs
b) 24 VAC Triac

5) Configurable Outputs - shall be capable of the following:

a) Analog Output, Voltage Mode
b) Binary Output Mode

j. The FAC shall have the ability to reside on a Field Controller Bus (FC Bus).

1) The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
2) The FC Bus shall support communications between the FACs and the NAE.
3) The FC Bus shall also support Input/Output Module (IOM) communications with the FAC and with the NAE.
4) The FC Bus shall support a minimum of 100 IOMs and FACs in any combination.
5) The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FAC and the furthest connected device.

k. The FAC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

1) The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
2) The SA Bus shall support a minimum of 10 devices per trunk.
3) The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FAC and the furthest connected device.

l. The FAC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.

m. The FAC shall support, but not be limited to, the following applications:

1) Heating central plant applications
2) Built-up air handling units for special applications
3) Terminal & package units

4) Special programs as required for systems control

n. The FAC shall support a Local Controller Display as an integral part of the FAC or as a remote device communicating over the SA Bus.

1) The Display shall use a BACnet Standard SSPC-135, clause 9 Master-Slave/Token-Passing protocol.
2) The Display shall allow the user to view monitored points without logging into the system.
3) The Display shall allow the user to view and change setpoints, modes of operation, and parameters.
4) The Display shall provide password protection with user adjustable password timeout.
5) The Display shall be menu driven with separate paths for:

a) Input/Output
b) Parameter/Setpoint
c) Overrides

6) The Display shall use easy-to-read English text messages.
7) The Display shall allow the user to select the points to be shown and in what order.
8) The Display shall support a back lit Liquid Crystal Display (LCD) with adjustable contrast and brightens and automatic backlight brightening during user interaction.
9) The display shall be a minimum of 4 lines and a minimum of 20 characters per line
10) The Display shall have a keypad with no more than 6 keys.
11) The Display shall be panel mountable.

2. VAV Modular Assembly (VMA 16XX)

a. The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
b. The VMA shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

1) The VMA shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
2) A BACnet Protocol Implementation Conformance Statement shall be provided for the VMA.
3) The Conformance Statement shall be submitted 10 days prior to bidding.

c. The VAV Modular Assembly shall communicate over the FC Bus using BACnet Standard protocol SSPC-135, Clause 9.
d. The VAV Modular Assembly shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.

e. The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
f. The VAV Modular Assembly shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB or the controller is designed and suitable for use in other environmental air space (plenums) in accordance with Section 300.252(C) of the National Electrical Code.
g. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 60 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
h. The controller shall determine airflow by a state-of-the-art digital non-flow pressure sensor to provide 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections; this pressure sensor eliminates high- and low-pressure connection mistakes.
i. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.
j. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
k. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
l. The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
m. Control setpoint changes initiated over the network shall be written to VMA non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
n. The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.
o. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
p. The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
q. Controller performance shall be self-documenting via on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate exponentially weighted moving averages (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.

    1) Absolute temperature loop error
    2) Signed temperature loop error
    3) Absolute airflow loop error
    4) Signed airflow loop error

5) Average damper actuator duty cycle

r. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:

1) Unreliable space temperature sensor
2) Unreliable differential pressure sensor
3) Starved box
4) Actuator stall
5) Insufficient cooling
6) Insufficient heating

s. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VMA would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.

t. The controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality), and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.

u. The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.

v. Inputs:

1) Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:

a) 0-10 VDC Sensors
b) 1000ohm RTDs
c) NTC Thermistors

2) Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
3) For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.
4) Provide side loop application for humidity control.

w. Outputs

1) Analog outputs shall provide the following control outputs:

a) 0-10 VDC

2) Binary outputs shall provide a SPST Triac output rated for 500mA at 24 VAC.
3) For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.

x. Application Configuration

1) The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.

y. Sensor Support

1) The VAV Modular Assembly shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
2) The VMA shall support an LCD display room sensor.
3) The VMA shall also support standard room sensors as defined by analog input requirements.
4) The VMA shall support humidity sensors defined by the AI side loop.

3. Network Sensors (NS-XXX-700X)

a. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:

1) Zone Temperature
2) Zone Humidity
3) Zone Setpoint
4) Discharge Air Temperature
5) Zone CO2

b. The NS shall transmit the information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.

c. The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

1) The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
2) A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
3) The Conformance Statement shall be submitted 10 days prior to bidding.

d. The Network Zone Temperature Sensors shall include the following items:

1) A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
2) An LED to indicate the status of the Override feature
3) A button to toggle the temperature display between Fahrenheit and Celsius
4) A button to program the display for temperature or humidity
5) A button to initiate a timed override command
6) Available in either surface mount, wall mount, or flush mount
7) Available with either screw terminals or phone jack

e. The Network Discharge Air Sensors shall include the following:

1) 4 inch or 8 inch duct insertion probe
2) 10 foot pigtail lead
3) Dip Switches for programmable address selection
4) Ability to provide an averaging temperature from multiple locations
5) Ability to provide a selectable temperature from multiple locations

f. The Network CO2 Zone Sensors shall include the following:

1) Available in either surface mount or wall mount
2) Available with screw terminals or phone jack

4. Networked Thermostat (TEC 26X6)

a. The networked thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters or other similar equipment.
b. The TEC shall communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
c. The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

1) The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
2) A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
3) The Conformance Statement shall be submitted 10 days prior to bidding.

d. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.
e. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.

1) Two line, 8 character backlit display
2) LED indicators for Fan, Heat, and Cool status
3) Five (5) User Interface Keys

a) Mode
b) Fan
c) Override
d) Degrees C/F
e) Up/Down

4) The display shall continuously scroll through the following parameters:

a) Room Temperature
b) System Mode
c) Schedule Status – Occupied/Unoccupied/Override
d) Applicable Alarms

f. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:

1) Integral Indoor Air Temperature Sensor
2) Duct Mount Air Temperature Sensor
3) Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
4) Two configurable binary inputs

g. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:

1) Three Speed Fan Control
2) Two On/Off
3) Two Floating
4) Two Proportional (0 to 10V)

h. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.

i. The Networked Thermostat shall provide the flexibility to adjust the following parameters:

1) Adjustable Temporary Occupancy from 0 to 24 hours
2) Adjustable heating/cooling deadband from 2º F to 5º F
3) Adjustable heating/cooling cycles per hour from 4 to 8

j. Where required by application and indicated on plans or room schedules provide the Networked Thermostat with an integral Passive Infra-Red (PIR) occupancy sensor.

k. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

2.5 MISCELLANEOUS DEVICES

A. Thermostats

1. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
2. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
3. Thermostats shall be arranged for either horizontal or vertical mounting.
4. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
5. Mount the thermostat covers with tamper-proof socket head screws.

B. Current Sensing Relay:

1. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.

2. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
3. Provide for status device for all fans and pumps.

PART 3 - EXECUTION

3.1 NETWORKING/SYSTEM ARCHITECTURE

A. Graphic Workstations – Install Graphic Workstations that meet the requirements of the above Sections.

B. Hardwired Network Communications – Provide network connections between all controllers and workstations. Install communications trunk in conduit.

3.2 SEQUENCE OF OPERATION

A. See Drawings

3.3 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories. All controls signal and power wiring shall be in EMT conduit. Provide rigid conduit in utility, CUP areas and outdoors.

B. Provide conduit and wiring between all control devices and the nearest standby power source. In general 120V, 20A control circuits have been provided in designated panel boards.

C. All exposed low voltage electrical control wiring throughout the building shall be run in accordance with the requirements of Division 26.

D. Install all line voltage wiring, concealed or exposed, in accordance with Division 26.

E. Low voltage electrical wiring above accessible ceilings may be run in plenum cable.

F. Supply/Install all necessary transformers/power supplies as required to power BAS instrumentation.

G. Perform all wiring in accordance with all local and national codes.

3.4 COMMISSIONING, TESTING AND ACCEPTANCE

A. Submit the testing and procedures for the architects review. All proposed operational testing procedures and forms are to be submitted to the architect prior to execution of the test. The Owner's Representative's designated Representative has the option to witness all tests.

B. Submit the results of functional and diagnostic tests and calibrations to the architect in a three ring binder (including table of contents and tabs) for final system acceptance. System will not be considered complete until all tests listed in following "Section 3" are successfully completed and documented. Provide documentation of all On-Site Testing to The Owner's Representative as part of the O&M package.

C. Test to consist of the following:

1. Point to Point Installation Verification of all BAS I/O.
2. Terminal Box Controller Startup and Verification.
3. Hardwired Interlock Verification.
4. Sequence of Operation Verification.
5. 72 Hour Functional Test.

D. Point to Point Installation Verification Procedure to consist of the following (as a minimum):

1. Documentation - An Excel spreadsheet listing all I/O in the system including point name, address, MBC#, method of I/O test used per point. Provide one signature block per page for contractor's representative and The Owner's Representative's representative to accept the test results.
2. Digital/Analog Inputs: Jumper the wires at the device and verify change of state at controller and/or Graphic workstation. Record results on spreadsheet.
3. Digital/Analog Outputs: Command the field device from the controller and verify corresponding change of state at the field device. Record results on spreadsheet.

E. Terminal Box Controller startup Procedures to consist of the following (as a minimum):

1. Documentation - An Excel spreadsheet listing all terminal box controllers in the system including Box #, Controller Address, Application Type, Application #, Flow Ranges, etc. Provide one signature block per page for contractor's representative to accept test results.
2. Sequence of Operation Verification Procedures to consist of the following (as a minimum):

    a. All PID Control Loops are tuned prior to start of the sequence of operations verification. Tuning Parameters for all loops are included in a tabular format.
    b. A detailed sequence of operation is provided for each system, including instructions for testing the sequence.
    c. A checkout form is provided for each system/sequence. Checkout form is to include areas to check and record each facet of the sequence of operations including, but not limited to the following:

1) Start/Stop
2) Interlocks
3) Safeties
4) PID Loops
5) Modes of Operation
6) Powerfail/Recovery

d. Checkout form is intended to be a functions (yes/no/comment) test form.

3.5 GUARANTEE/WARANTEE:

A. General Requirements: Provide all services, materials and equipment necessary to the successful operation of the entire BAS system for a period of one year after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work.

B. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. The Owner's Representative shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

C. The Owner's Representative will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the complete system. Furnish the Owner's Representative with a telephone number where service representative can be reached at all times. Service personnel shall be at the site within 24 hours after receiving a request for service.

D. Operation: Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the initial performance test.

E. Systems Modifications: Provide any recommendations for system modification in writing to the Owner's Representative. Do not make any system modifications, including operating parameters and control settings, without prior approval of the Owner's Representative. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

F. Software: The Owner's Representative shall be apprised of software updates and provided an option to incorporate them into the system, if the Owner's Representative so desires.

END OF SECTION 230900

SECTION 232113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Hydronic piping systems.

1.2 RELATED WORK

A. Section 230500 - Basic HVAC Requirements.

B. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

C. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 230719 - HVAC Piping Insulation.

1.3 SUBMITTALS

A. Shop Drawings and Product Data:

1. Refer to Section 013300 for procedure.
2. Furnish the following:

    a. Manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting.
    b. Piping schedule showing manufacturer, pipe weight, fitting type, and joint type for each piping system.

1.4 REFERENCE STANDARDS

A. ANSI/ASME SEC. 9 - Welding and Brazing Qualifications.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

C. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

D. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

E. ANSI/ASME B31.1 - Code for Power Piping.

F. ANSI/ASME B31.9 - Building Services Piping.

G. ANSI/AWS A5.8 - Brazing Filler Metal.

H. ANSI/AWS D1.1 - Structural Welding Code.

I. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

J. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

K. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

L. ASTM B32 - Solder Metal.

M. ASTM B88 - Seamless Copper Water Tube.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9 and ANSI/ASME B31.1.

1.6 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Include data on pipe materials, pipe fittings, valves and accessories.

C. Welders Certification: In accordance with ANSI/ASME SEC 9 and ANSI/AWS D1.1

1.7 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Include data on pipe materials, pipe fittings, valves and accessories.

C. Include welder's certification of compliance with ANSI/ASME SEC 9 and ANSI/AWS D1.1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heating Water: 2 inches and smaller, black steel, threaded; 2-1/2 inches and larger, black steel, welded. Victaulic fittings or Type L copper tubing 4 inches and smaller, Type K copper tubing 5 inches and larger acceptable.

B. Chilled Water: 2 inches and smaller, black steel, threaded; 2-1/2 inches and larger, black steel, welded. Victaulic fittings or Type L copper tubing 4 inches and smaller, Type K copper tubing 5 inches and larger acceptable.

C. Chemical Feed: Pipe for closed system pot feeders and for sampling piping, same as piping system being fed except as indicated otherwise. Pipe for chemical injection polypropylene or as compatible with entire range of chemicals being used.

D. Relief and Vent: 2 inches and smaller - black steel, threaded; 2-1/2 inches and larger - black steel welded.

E. Condensate Drains from Coils.

F. Humidifier and Miscellaneous Drains: Type L copper for water, black steel on steam system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water Piping:

1. Comply with Section 230529 and as indicated herein.
2. Run piping generally as indicated on the Drawings.
3. Run exposed piping parallel to structure, vertical lines plumb and as approved by the Architect.
4. Make allowance for expansion in the installation of all piping so that the usual variation in temperature will not cause undue stress at any point. Securing anchor pipes where necessary to properly distribute expansion stresses.
5. Use eccentric fittings for all changes in pipe sizes of supply and return lines arranged to prevent trappage of air, except where reducing tees are used.
6. Install flanged elbows for water connections to equipment with heat exchangers to allow easy removal of tube bundles. Place no obstruction in space required for tube removal.
7. Provide concealed high points with air chambers with 1/4-inch copper tube vent line and stop cock carried to accessible point.
8. Pitch water piping for drainage where possible, or run level. Provide Chicago No. 7T 3/4-inch drain valves at all low points.
9. Piping at Coils: Piping as coil banks shall be made up to include gate valve, flow measuring device, modulation control valve, balancing cock, Pete's plug in and out, and strainers before each control valve.

3.2 FIELD QUALITY CONTROL

A. Piping System Leak Tests:

1. Make pressure tests in the presence of the Owner's Representative.
2. Perform all pressure tests with the use of a Bristol recording gauge, and a record of all tests kept for hand-over to the Owner.

END OF SECTION 232113

SECTION 232213.23 – STEAM AND STEAM CONDENSATE PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide a complete system for steam and condensate pipes within the building.

B. Contractor to design anchors, guides, supports and expansion compensation systems based on coordinated piping layout as submitted in shop Drawings. Shop Drawings and calculations shall be stamped by an engineer licensed in the State of California. Pipe stresses as documented in the calculations shall meet the requirements of ANSI B31.1. No materials shall be purchased or fabricated before the contractor has completely responded to all comments on the submittal. Anchor and expansion compensation locations as shown on Contract Documents are suggested only.

1.2 RELATED WORK

A. Section 230500 - Basic HVAC Requirements.

B. Section 230509 - HVAC Piping Supports, Guides, Hangers and Anchors.

C. Section 230719 - HVAC Piping Insulation.

D. Section 222216 - Steam and Steam Condensate Specialties.

1.3 REFERENCES

A. American National Standards Institute (ANSI) Publications:

1. A5.8 Brazing Filler Metal.
2. A14.3 Safety Code for Fixed Ladders
3. B2.1 Pipe Threads (Except Dry Seal)
4. B16.3 Malleable-Iron Threaded Fittings
5. B16.5 Steel Pipe Flanges and Flanged Fittings
6. B16.9 Factory Made Wrought Steel Buttwelding Fittings
7. B16.11 Forged Steel Fittings, Socket-Welded and Threaded
8. B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
9. B16.23 Cast Copper Alloy Solder Joint Drainage Fittings - DWV
10. B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
11. B18.2.1 Square Head Bolts and Screws
12. B18.2.2 Square and Hex Nuts
13. B31.1 Power Piping
14. B31.9 Building Services Piping
15. D1.1 Structural Welding Code
16. Z49.1 Safety in Welding and Cutting

B. American Society of Mechanical Engineers (ASME) Publications:

1. Section VIII, Pressure Vessels
2. Section IX, Welding and Brazing Qualifications

C. American Society for Testing and Materials (ASTM) Publications:

1. A53 Welded and Seamless Steel Pipe
2. A106 Seamless Grade B Black Carbon Steel
3. A194 Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
4. A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
5. A307 Low-Carbon Steel Externally and Internally Threaded Standard Fasteners
6. B32 Solder Metal.
7. B88 Seamless Copper Water Tube.
8. B209 Aluminum-Alloy Sheet and Plate
9. C94 Ready-Mix Concrete
10. C533 Calcium Silicate Block and Pipe Thermal Insulation
11. C547 Mineral Fiber Preformed Pipe Insulation

D. American Welding Society (AWS) Publications:

1. B3.0 Qualification Procedure

E. California Department of Transportation (CDT) Publications:

1. Standard Specifications
2. Standard Drawings

F. Expansion Joint Manufacturers Association (EJMA) Publication:

1. Standards of Expansion Joint Manufacturers Association

G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications:

1. SP-58 Pipe Hangers and Supports -- Materials, Design, and Manufacturer
2. SP-69 Pipe Hangers and Supports -- Selection and Application

H. Expansion Joint Manufacturer's Association (EJMA) - Standards

1.4 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.1.

1.5 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Include data on pipe materials, pipe fittings, valves and accessories.

C. Welder's Certification: In accordance with ASME Section VIII, pressure vessels, and ASME Section IX, welding and brazing qualifications. Welders to be thoroughly familiar with ANSI B31.1 requirements.

D. Welded joints of high pressure steam pipes are to be radiographed by an independent testing agency as part of this Contract. Contractor to retain testing agency.

1.6 SUBMITTALS

A. Submit under provisions of Division General Requirements, Section 013300 Submittal Procedures, Section 016000 Product Requirements, and Section 012500 Substitution Procedures as applicable.

B. Manufacturer's Data: Drawings, catalogs, cut-sheets, specifications and data sheets for all materials and equipment (Pipe materials, pipe fittings, valves, expansion joints, etc.).

C. Welders Performance: All applicable welding procedures, welder certification, and procedure qualification records.

D. Shop Drawings: Submit Drawings of entire system, at one time. Include anchor/guide/support locations and design, expansion calculations, evaluation of pipe stresses, and description and design of expansion compensation systems. Confirm compliance with ANSI B31.1, latest edition. Drawings and calculations are to be stamped by a licensed engineer registered in the state of California. When preparing calculations to ANSI 31.1, do not use friction at pipe supports to resist motion due to a seismic event per the California Building Code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage, in accordance with 01 60 00 Material and Equipment:

1. Materials shall be stored on site in enclosures or under protective coverings. Materials shall not be stored directly on ground.
2. Insulation, expansion joints, joint materials, fittings, valves, and gaskets, shall be stored under cover out of direct sunlight.

B. Handling: Pipe sections, fittings, valves and other accessories shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition.

PART 2 - PRODUCTS

2.1 STEAM PIPING

A. Steel Pipe: ASTM A-106, Seamless Grade B; black carbon steel Schedule 40 to a maximum of 10 inch diameter.

B. Fittings

1. Threaded or socket weld (2 inch and smaller): ANSI B16.11 forged carbon steel, ASTM A105, 2000 lb. class.
2. Butt welded (2.5 inch and larger): ANSI B16.9, ASTM A234 WPB, Schedule to match pipe.
3. Flanged (2.5 inch and larger): ANSI B16.5, ASTM A105 forged steel, weld neck flanges. Use 150 or 300 lb. class at equipment to match equipment. Use 300 lb. class for all piping exposed to the full pressure of the campus distribution system (upstream of pressure reducing station). Use 300 lb. class flanges for entire PRV station.
4. Unions (2 inch and smaller): ANSI B16.11 forged carbon steel, 800 lb. class.
5. Dielectric flange sets shall be rated for the intended service.

C. All buried steel fittings shall be butt welded, all sizes, no exceptions.

2.2 STEAM CONDENSATE PIPING

A. General: Condensate system begins at the discharge of the steam trap. Piping upstream of the steam trap shall be constructed to steam system standards. Bypass around trap shall be constructed to steam system standards.

B. In Building: Schedule 80 steel – ASTM A106 Seamless Grade B. Fittings and valves same as steam, except use 150 lb. valves in lieu of 300 lb.

C. For piping in vaults and direct buried, see Section 15183 - Underground Steam and Condensate Piping.

2.3 STEAM STAM PIPING

A. High grade stainless steel piping, welded joints.

2.4 Steam VALVES

A. General: Threaded, 2 inch and smaller; flanged, 2.5 inch and larger. No valves shall be direct buried. No welded valves. Valve Manufacturers per this section, not Section 15110 Valves.

B. Gate Valves

1. Threaded (2 inch and smaller): ANSI B16.34, 800 lb. class, forged steel bolted bonnet, OS&Y, conventional port gate valve. Walworth, Vogt, Edwards.
2. Flanged (2.5 inch and larger): ANSI B16.34, 300 lb. class, A216 WCB cast steel body, bolted bonnet, OS&Y, stainless steel trim. Walworth, Stockham. Use 150 lb. class downstream of pressure reducing station.
3. Warmup lines: All gate valves 4 inches and larger shall have bypass lines with appropriately sized warmup valves.

C. Globe Valves

1. Threaded (2 inch and smaller): ANSI B16.34, 800 lb. class, forged steel body, stainless steel seat ring and plug, bolted bonnet, rising stem. Walworth, Vogt, Edwards.
2. Flanged (2.5 inch and larger): ANSI B16.34, 300 lb. class, A216 WCB cast steel body, OS&Y; stainless steel trim, Walworth, Stockham. Use 150 lb. class downstream of pressure reducing station.

D. Ball Valves

1. Threaded (2 inches and smaller): 300 lb. class, steam-rated, cast steel/stainless steel. Nibco, Walworth, Crane. Do not use in guard or blowdown applications.

E. Check Valves (condensate systems and vacuum breakers only)

1. Threaded (for steam trap discharge): 800 lb. class, forged steel, stainless steel disc, swing check. Vogt, Edwards, Walworth.
2. Flanged (2.5 inch and larger): ANSI B16.34, 150 lb. class, A216 WCB cast steel body, bolted flange cover, swing check; Walworth, Stockham.

2.5 CONDENSATE SYSTEM VALVES

A. 150 pound, brass or bronze construction, rated for steam condensate service.

2.6 PIPING SPECIALTIES

A. Gaskets: Non-asbestos ring gaskets, flexitallic type cg 304SS, suitable for the fluids and temperatures encountered, and as thin as the finished surfaces of the flanges permit.

B. Bolting: ASTM A193, Grade B7, for bolts and studs, and ASTM A194, Grade 2H for nuts; with dimensions conforming with ANSI B18.2.1 and ANSI B18.2.2 and threads conforming with ANSI B2.1, coarse, Class 2A fit for bolts and studs, and Class 2B fit for nuts.

C. Air Traps: Float controlled, steel body, stainless steel operating part, designed to close promptly when water enters trap.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Piping shall be fabricated, assembled, welded, installed and tested in accordance with ANSI B31.1.

B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space, other work, or equipment.

D. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment. Refer to Division 23 Section - Pipe and Pipe Fittings.

E. Provide clearance for installation of insulation and access to valves and fittings.

F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083113 Access Doors and Frames.

G. Use eccentric reducers to maintain bottom of pipe level in horizontal steam and steam condensate piping, bottom side flat.

H. Run condensate lines from trap to nearest condensate main or receiver. Provide loop vents over trapped sections. Provide dirt pocket with blowoff valve and hose connection.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply 1 coat of zinc rich primer to welding.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Section 099123 Interior Painting.

K. Install valves in accordance with ANSI B31.1 and ASME Section VIII. Install with stems upright or horizontal, not inverted. Lubricate all flange bolts with high temperature bolt lubricant. Tighten bolts in an incremental, staggered pattern, to assure even compression of the gasket. See Section 230523 General Duty Valves for HVAC Piping for other installation requirements.

L. Install drip legs at low points and natural drainage points such as at ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.

M. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 200 feet where pipe is pitched down in direction of the steam flow, and maximum 150 feet where pipe is pitched up so condensate flow is opposite of steam flow. Locations are not all shown.

N. Size drip legs at vertical risers full size and extend beyond the rise. Size drip legs at other locations same diameter as the main. Provide 18 inch drip leg for steam mains smaller than 6 inches. In steam mains 6 inches and larger, provide drip legs sized 2 pipe sizes smaller than main, but not less than 4 inches diameter and 28 inches long.

O. Install steam traps close to drip legs.

P. Minimum pipe size 3/4 inch.

Q. Flash Tanks: Pitch condensate lines towards flash tank. If more than 1 condensate line discharges into flash tank, install swing check valve in each line. Vent the top of the tank.

R. Wye-type Strainers: Ahead of all pressure reducing valves, steam traps and similar devices.

S. Install swing check valves as required to control flow direction, and to serve as vacuum breakers.

T. Connect branch connection to supply mains using tee fitting in main connected to 45 degree fitting in branch with take-off out top of main. 90 degree fittings at branch connection to the main are permissible where 45 degree fitting is not practical. Where length of branch is less than 10 feet, pitch branch line down toward mains, 0.5 inch per 10 feet.

U. Cleaning: Each section of pipe, fittings, and valves shall be thoroughly cleaned free of all foreign matter before erection. Interior of piping shall be washed out thoroughly with water before final connections are made. Open ends of mains shall be plugged or capped during shutdown periods. Lines shall not be left open at any place where foreign matter might accidentally enter pipe.

V. Painting: Color code the outside of the insulation jacket as follows. Color code whether or not the pipe is exposed. Paint the entire jacket.

1. Steam: Red.
2. Steam Condensate Return: Orange.

W. Welding

1. Responsibilities of Contractor for Fusion Welding:

    a. Contractor shall be responsible for the quality of all welding.
    b. Contractor shall be capable of performing all welding operations required for construction and installation of the steam distribution and condensate return system.
    c. Contractor shall determine the suitability of welding procedures used to ensure that welds meet the requirements specified herein.
    d. Contractor shall be thoroughly familiar with ANSI B31.1, ANSI Z49.1, and AWS B3.0.

2. Beveling: Field bevels and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be ground and thoroughly cleaned of scale and oxidation just prior to welding. Beveling shall conform to ANSI standards.

3. Welds shall be visually inspected in accordance with ANSI B31.1 requirements. The Contractor shall also retain an independent testing agency to radiograph (x-ray) 10 percent of welds at high pressure steam lines from the point of entry to the mechanical room through the pressure reducing stations, both field and factory welds.
4. Defective Welds: Welds found to be defective either by inspection or by radiography shall be replaced (cut out and pipes re-welded) by the Contractor and re-inspected. Repair of defective welds by adding weld material over the defect or by peening shall not be permitted. Welders responsible for defective welds shall be re-qualified before performing more welding on the job.
5. Electrodes shall be stored in a dry, warm area; kept free of moisture during fabrication operations. Electrodes that have lost part of their coatings shall be discarded.
6. All finished welds shall be painted with high temperature black paint.

END OF SECTION 232213.23

SECTION 232216 – STEAM AND STEAM CONDENSATE SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Steam Traps.

B. Pressure Reducing Valves.

C. Drip Pan Elbows.

D. Blow Down Separator/Aftercooler.

E. Steam Separator.

F. Steam and Condensate Expansion Joints.

G. Automatic Air Vents.

H. Strainers.

I. Steam Main Vents.

J. Steam Pressure Reducing Valves.

K. Automatic Pump Trap.

L. Steam Condensate Meter.

1.2 RELATED WORK

A. Section 230523 – General Duty Valves for HVAC Piping.

B. Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 230719 – HVAC Piping Insulation.

D. Section 232213 23 - Steam and Steam Condensate Piping.

1.3 REFERENCES

A. ANSI/ASTM - Boilers and Pressure Vessels Code.

B. ASTM A105 - Forgings, Carbon Steel, for Piping Components.

C. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings.

D. ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, for high Temperature Service.

E. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

F. ASME B31.1 – Power Piping.

1.4 REGULATORY REQUIREMENTS

A. Conform to ASME B31.1 - Power Piping.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.6 SUBMITTALS

A. Submit product data under provisions of Section 013300 – Submittal Procedures.

B. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.

C. Submit schedule indicating manufacturer, model number, size, location, rated capacity, and features for each specialty.

D. Submit manufacturer's installation instructions under provisions of Section 017823 – Operation and Maintenance Data.

E. Relief valves, steam valves and steam relief valves shall be MOP (maintenance operation procedure) certified for field service.

F. Size and provide steam trap selections based on capacities shown on steam piping diagrams. Refer to 3.1.F.

PART 2 - PRODUCTS

2.1 STEAM TRAPS

A. Manufacturers (Except TD Type)

1. Hoffman.
2. Spirax Sarco.
3. Armstrong.

B. Inverted Bucket Traps - IB

1. Cast iron body and bolted cover for 250 psig WSP; provide access to internal parts without disturbing piping; with top test plug and bottom drain plugs, stainless steel bucket, stainless steel seats and plungers, and stainless steel level mechanism with knife edge operating surfaces, integral inlet strainer of stainless steel, integral check valve.

C. Float And Thermostatic Traps – F & T

1. ASTM A126, cast iron body and bolted cover for 250 psig WSP; provide access to internal parts without disturbing piping; with bottom drain plug, stainless steel or bronze bellows type air vent, stainless steel float, stainless steel lever and valve assembly.

D. Thermodynamic traps - TD

1. Disk type, steel body, 3/4 minimum size. Spirax Sarco TD, Yarway #721, Nicholson TD 301.

E. Clean steam traps.

F. Full stainless steel construction body and internal parts compatible for clean steam applications.

2.2 PRESSURE REDUCING VALVES

A. Manufacturers

1. Spirax Sarco.
2. Leslie GPS.
3. Watson McDaniel.

B. Cast steel body, stainless steel valve spring, seat, stem, trim, and diaphragm, pilot operated. 300 psi at 600 degrees F. Interchangeable pressure pilot springs, calibrated temperature pilot dial, overheat protection, non-compressible fluid fill thermostat.

C. All Pressure Reducing Valves shall be flanged. Threaded valves shall only be considered at the specific request of the Owner's Representative after the submittal of the stress analysis required by Section 232213.23 – Steam and Steam Condensate Piping.

D. Provide integral electronic transmitter for remote shutoff.

E. Provide factory acoustic blanket. Rating temperature of 600 degrees F. Insulation jacket shall be teflon coated fiberglass.

2.3 DRIP PAN ELBOWS

A. Manufacturers

1. Spirax Sarco.

2. Armstrong.
3. Hoffman.

B. Discharge elbow and drip pan for safety valves. NPT for 2 inches and smaller; flanged for 2.5 inches to 8 inches. Full size of safety valve outlet size. Drain taps on both drip pan and elbow.

2.4 BLOW DOWN SEPARATOR/AFTERCOOLER

A. Manufacturers

1. Cemline.
2. Nortec.
3. Bryan.
4. Cleaver Brooks.

B. Vessel shall comply with requirements of ASME Section VIII. Stamped for 150 psig working pressure.

C. Stainless steel striking plate, wall baffles, and spiral baffle.

D. 150# flanged vent and drain connections (3 inches and larger). 3000# threaded couplings (2-1/2 inches and smaller).

E. Angle iron legs fully welded to tank and angle iron leg pad. Bolt to floor. The stand shall elevate the separator to provide access for aftercooler and drain connection.

F. Aftercooler shall be mounted below separator and shall include the following connections:

1. Thermometer.
2. Cold water inlet.
3. Temperature regulating valve sensing bulb.
4. Blow down separator.
5. Drain.

G. Aftercooler to include thermometer, automatic discharge temperature regulating valve (with strainer and check valve), and temperature sensing bulb for control of temperature regulating valve. Aftercooler assembly shall maintain a maximum discharge temperature to drain of 140 degrees F.

2.5 STEAM SEPARATORS

A. Manufacturers

1. Spirax Sarco, numbers used for convenience.
2. Armstrong.
3. Hoffman.

B. Horizontal: 1-1/2 inch to 8 inch Model S3. Cast iron, maximum operating pressure 150 psi at 650 degrees F, ANSI 150 flanged inlet and outlet, threaded bottom drain.

2.6 STEAM AND CONDENSATE EXPANSION JOINTS

A. Expansion joints shall be the shrouded, externally pressurized bellows type as designed for the specific location. They shall be 250 psig steam rating, flanged, and shall conform to the Standards of the Expansion Joint Manufacturers Association.

B. 316 Stainless Steel bellows, single or double bellows style as required for the intended service: Hyspan, Pathway, Senior Flexonics.

C. Manufacturer shall design and engineer thermal expansion system installation drawings substantiating adequacy of system installed.

2.7 FLASH TANK

A. Construct flash tank of copper bearing steel, ASTM A 285, for a steam working pressure of 125 psi to comply with ASME Code and label accordingly.

1. A corrosion allowance of 1/16 inch may be provided in lieu of the copper bearing requirement.
2. Provide tank supports.
3. Refer to schedule on Drawings.
4. Provide relief valve vented to atmosphere.

2.8 STRAINERS

A. Strainers (for use on steam trap stations): Y-type with cast or forged steel body, 1/16 inch mesh monel strainer elements, threaded for 2 inch and smaller piping; C.M. Bailey, Spirax Sarco IT.

2.9 CONDENSATE RETURN PUMPS - FLOOR MOUNTED

A. General: Provide packaged duplex pressure powered condensate return pump sets consisting of a cast iron receiver and other accessories as shown on schedule drawings. Refer to Drawings for capacities and manufacturer.

2.10 AUTOMATIC PUMP TRAP

A. Manufacturers

1. TLV Corporation
2. Spirax Sarco

B. Cast iron body with inlet check valve and outlet check valve. The internal trap mechanism shall contain a stainless steel float connected to an internal trap.

2.11 STEAM CONDENSATE METER

A. See Section 230923 Instrumentation and Controls for HVAC. Niagara MTX 413.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions.

B. Unless shown differently on Drawings, install float and thermostatic traps to drain condensate from unit heaters, converters, heating coils, steam separators, flash tanks, steam jacketed equipment, sterilizers, washers, humidifiers and direct steam injected equipment and sterilizers.

C. Unless shown differently on Drawings, install inverted bucket steam traps to drain condensate from steam main headers and branch lines into gravity returns.

D. Install test valve downstream of all steam traps.

E. Install thermodynamic steam traps to drain high-pressure drips into pumped returns.

F. Size steam traps to handle minimum of 2 times maximum condensate load of apparatus served.

G. Traps used on steam mains and branches shall be minimum 3/4 inch size.

H. Install steam traps with union or flanged connections at both ends.

I. Provide dirt pocket, gate valve, strainer and union at inlet, and union, gate valve and check valve at discharge of steam traps.

J. Provide minimum 15 inch long dirt pocket of same pipe sizes as apparatus return connection between apparatus and steam trap, 8 inch long dirt pocket below inlet connection to steam trap. Provide blowoff valve at all dirt pockets whether indicated or not.

K. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.

L. Rate relief valves for pressure upstream of pressure reducing station, for full operating capacity. Set relief at maximum 20 percent above reduced pressure.

M. Provide steam trap assembly at all low points of steam piping, at bottom of all steam risers and drops and at each piece of equipment, separately, whether or not indicated on Drawings.

N. Install traps and control valves in accessible locations as close as possible to equipment. Maximum allowable distance from equipment 4 feet.

O. Install bypass piping with globe valve around control valve. Where multiple, parallel control valves are installed, only 1 bypass is required.

P. Install vacuum breaker downstream from control valve and bypass, as close as possible to the coil inlet connection.

Q. Install globe valves so that the pressure is below the disk. Install globe valves with the stems horizontal on steam and exhaust lines.

R. Install pressure gauges at equipment inlet steam connection.

S. Pressure Gauges: Install cock between each pressure gauge and the pipe; provide siphon pigtail ahead of gauge at gauges on steam lines.

T. Safety Valve Installations:

1. Install relief valves in accordance with and where required by ASME B31.1-Power Piping. Pipe discharge to atmosphere outside building, without stop valves. Terminate vent pipe with screened vent cap.
2. Install drip pan elbow fitting adjacent to safety valve. Pipe drip pan elbow drain connection to over nearest floor drain without valves. Comply with ASME Boiler and Pressure Vessel Code for installation requirements.

U. Rate relief valves for pressure upstream of pressure reducing station, for full operating capacity. Set relief at maximum 20 percent above reduced pressure.

V. Pressure Reducing Valves

1. General: Install pressure reducing valves as required to regulate system pressure. Install in location readily accessible for maintenance and inspection. Provide all fittings described below in addition to those shown explicitly on the drawings. Due to the stress concentrations that often develop at PRV stations, avoid threaded connections unless the stress analysis required by Section 232213.23 – Steam and Steam Condensate Piping confirms that threaded joints comply with code requirements.
2. Size reducing valves to supply maximum steam requirements of system or equipment at indicated inlet and outlet pressures.
3. Provide bypass around each reducing valve with globe valve equal in size to area of reducing valve seat ring.
4. Install gate valves and unions around each reducing valve. Unions may be omitted for reducing valves with flanged connections.
5. Install pressure gauges on high and low pressure side of each reducing valve and ahead of shutoff valve, plus 1 downstream for shutoff valve.
6. On 2-stage reducing stations, install drip trap and pressure gauge upstream from second stage reducing valve.
7. Install strainers upstream for each reducing valve. On 2-stage series reducing station omit strainer upstream from second stage, unless specifically indicated or otherwise required.
8. Install safety valves downstream from each reducing valve set at 5 psig higher than reduced pressure when reduced pressure is under 35 psig; and at 10 psig higher than reduced pressure, if the reduced pressure is above 35 psig or the first-stage of 2-stage reducing.

9. Provide minimum 10 pipe diameters of straight pipe downstream of each pressure reducing valve.

W. Pipe outlet from coils to drip leg. From drip leg, install appropriate trap, sized at 3 times the condensate load of equipment, at 1/2-psig differential.

3.2 TESTING

A. Test steam traps for proper performance.

B. Ensure minimum steam loss when strainers are cleaned.

C. Use steam traps installed at high points to release trapped air while filling. Use drip legs installed at low points for complete removal of liquid used for testing.

3.3 FLASH TANK

A. Vent tank to atmosphere (roof). Contractor to coordinate routing.

B. Provide related piping connections and valves.

C. For recovery systems, connect to low pressure system as per piping diagrams.

3.4 CONDENSATE RETURN PUMPS

A. Provide full sized receiver vent; terminate to atmosphere (roof).

B. Provide gate valve on inlet to receiver. Provide check valve in each pump discharge and increase discharge line 1 pipe size after joining lines.

C. Test and Commission equipment as required in other sections.

D. Insulate receiver tank.

3.5 SAFETY AND RELIEF VENTS

A. Terminate all relief vents to roof. Vents are to be insulated and provided with weather jacketing system. Contractor to coordinate final routing.

END OF SECTION 232216

SECTION 233113 – HVAC SHEET METAL DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal materials, fasteners, supports, and duct construction classifications for supply, return, and exhaust systems. Work includes outside air intake plenums.

B. Additional ductwork and associated sheet metal work includes:

1. Plenum partitions:

a. Factory fabricated.
b. Job constructed.

1.2 DEFINITIONS

A. Ductwork Sizes: Drawings state inside clear dimensions.

B. Other Definitions: Refer to SMACNA and ASHRAE.

1.3 QUALITY ASSURANCE

A. Comply with the following reference standards. Use most recent edition of all references.

1. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers Handbooks.
2. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.

a. Duct Construction Standards.
b. Fire Damper and Heat Stop Guide.
c. HVAC Systems Testing Adjusting and Balancing.
d. Guidelines for seismic restraints of mechanical systems and plumbing piping systems.

3. NEBB - National Environmental Balancing Bureau Manual: Procedural Standards for Testing - Balancing - Adjusting of Environmental Systems.
4. AABC - Associated Air Balance Council Manual: National Standards for Total System Balance.
5. ANSI - American National Standard Institute.
6. NFPA - National Fire Protection Association Standards: referred to as NFPA 90A, NFPA 90B, NFPA 96, etc.
7. UL - Underwriters Laboratories Standards for Safety: referred to as U.S. 181, U.L. 555, etc.

8. ACGIH - American Conference of Governmental Industrial Hygienists: Industrial Ventilation - A Manual of Recommended Practice.
9. UBC - Uniform Building Code.
10. UMC - Uniform Mechanical Code.
11. The State of California Codes.
12. Local Codes.
13. NUSIG - National Uniform Seismic Installation Guidelines.

B. Above referenced standards may be superseded by notes and details on Drawings and in specification.

C. Where two or more references conflict, the most stringent, as determined by Architect, shall take precedence.

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 013300 – Submittal Procedures.

B. Submit typical shop standards and/or SMACNA details for each class of duct specified, including particulars such as gauge sizes, welds, joint details, and fitting configurations prior to start of work.

C. Submit written report confirming ductwork has been fabricated and installed in accordance with SMACNA Standards.

D. Submit shop drawings of ductwork including elevations and showing all terminal unit and air device connections. Drawings shall be at a minimum scale of 1/4 inch = 1 foot – 0 inches.

E. Material VOC Content: Submit manufacturer's printed product data sheets and/or letters of certification on the manufacturer's letterhead for all adhesives, sealants, paints and coatings with evidence that they conform to the "Sustainable Design Quality Assurance" article of this Section for VOC content.

1. Highlight the VOC data for the material in grams per liter.
2. List the quantity of material to be used in gallons or liters.

1.5 FLOW DIAGRAMS

A. Construction Documents may include flow diagrams as a part of the working Drawings.

1. These flow diagrams are not for the purpose of giving physical dimensions or locations but rather to make clear the interconnections, by the duct systems, of the various units of the process.
2. If an item is shown on either the flow diagram or the Drawings, but not on both, it will be assumed that Contractor has included such item in the estimate of the cost of the work and that subject item will be provided.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufactured Round Ductwork:

1. Buckley.
2. Spiral Metal Corporation.
3. United Sheet Metal.

B. Duct Connection Systems:

1. Ductmate Industries, Inc.

C. Flexible Connections:

1. Ventfabrics.
2. Duro Dyne.

D. Duct Protective Coatings:

1. Wisconsin Protective Coating, Inc.
2. Varni-lite Corp. of America.

E. Duct Sealants:

1. Minnesota Mining and Manufacturing Co.
2. Benjamin Fostor Co.
3. Miracle Adhesive Co.
4. United Sheet Metal Division United McGill Corp.
5. Hardcast Corp., Inc.

F. Duct Connection Systems:

1. Ductmate Industries, Inc.

G. Flexible Connections:

1. Ventfabrics.
2. Duro Dyne.

H. Duct Protective Coatings:

1. Wisconsin Protective Coating, Inc.
2. Varni-lite Corp. of America.

I. Duct Sealants:

1. Minnesota Mining and Manufacturing Co.
2. Benjamin Fostor Co.

3. Miracle Adhesive Co.
4. United Sheet Metal Division United McGill Corp.
5. Hardcast Corp., Inc.

2.2 DUCT CONSTRUCTION CLASSIFICATIONS

A. General: Construct and seal ductwork in accordance with SMACNA pressure classifications and seal classes listed for ductwork systems involved.

B. Ductwork Classifications:

1. 1 inch WG Class with Seal Class C: Supply air ductwork downstream of terminal boxes and other fan coil/computer room cooling units.
2. 2 inches WG Class with Seal Class B: Exhaust air and return ductwork upstream of terminal air boxes.
3. 4 inches WG Class with Seal Class A: Supply air ductwork upstream of terminal boxes, exhaust ductwork downstream of terminal air boxes.

2.3 MATERIALS

A. Sheet Metal:

1. Steel sheets:

   a. Cold rolled soft steel sheets.
   b. Meeting ASTM 526-64T.
   c. Black or galvanized as specified.
   d. Galvanizing: G-90. ASTM 525 commercial coating class G 90 on both sides.

2. Aluminum sheets:

   a. Meet requirements of ASTM B209-64.2.1.4.
   b. Base allows not more than 0.40 percent copper.
   c. Mill finish.
   d. Commercial sheet: 16,000 psi

3. Stainless Steel Sheets:

   a. AISI Type 316.
   b. Concealed: Finish No. 2B or No. 3.
   c. Exposed: Finish No. 3 or No. 4.

4. Lead Sheets:

   a. Federal Spec. QQ-L-301a. Grade C.
   b. 6mm thick.
   c. Miscellaneous Products:

5. Screws and rivets.

a. Same material as sheet, except as noted.
b. On aluminum sheets, provide cadmium plated or stainless steel.
c. Zinc or cadmium plated permitted on galvanized sheets.
d. Minimum screw size: No. 10.
e. Minimum rivet size: 4 pound.

6. Duct Sealants:

a. Sealing compound: Similar to 3M Brand No. 700.
b. Tape: Similar to 3M NO. 474.
c. Gaskets:

1) Continuous, reinforced, inert, self-conforming type.
2) 1/8 inch thick.
3) Width: To match angle connection.
4) Similar to 3M Weatherban Sealant Tape 1202.

7. Hard-setting joint tape:

a. Two-part tape:

1) Mineral impregnated woven fiber tape.
2) Impregnated with activator/adhesive of polyvinyl acetate type.

8. UL Listed

a. Flame spread: 10.
b. Smoke contributed: 0.
c. Similar to Hardcast™

9. Spring Fasteners:

a. Oval head stud and receptacle.
b. Screwdriver slot.
c. Self-ejecting.
d. Similar to Ozus.

10. Angles, tie rod and shapes for reinforcing ducts:

a. In accordance with SMACNA HVAC Duct Construction Standards, except as noted.

11. Duct connection system:

a. Transverse bolted duct joints.
b. Factory fabricated components.
c. Flanges with sealant.
d. Permanent, non-hardening.
e. Corner pieces.
f. Assemble with gasket tape.
g. Similar to Ductmate Industries "Ductmate 35."
h. Transverse duct connections.

B. Turning Vanes

1. Galvanized steel ductwork: Galvanized steel or painted black steel, except as noted.
2. Other ductwork: Same material as ductwork.
3. Construction per "HVAC Duct Construction Standards" for:

    a. Single wall vanes.
    b. With 3/4 inch trailing edge.
    c. Use only in ducts with maximum air velocity below 2000 fpm.
    d. Double wall vanes:

        1) Use in ducts with maximum air velocity of 2000 fpm or higher.

    e. Vane length:

        1) Provide separate equal size sections for vane length greater than those indicated in referenced "Standards."

    f. Vane runners:

        1) Type 1 or 2 acceptable.
        2) Submit any other type for approval.

    g. Vane radius:

        1) 2 inch radius: Duct width up to inches.
        2) 4-1/2 inch radius: Duct width inches or larger.

C. Round Duct Take-Off Fittings

1. Factory-fabricated spin-in fitting.
2. Die-formed galvanized steel.
3. Pressure ratings:

    a. Standard construction: Up to 1/2 inch static pressure.
    b. Special construction: Up to 2 inches static pressure.

4. Balancing damper.

    a. Spring loaded.
    b. Locking regulator.

5. Similar to Young Manufacturing.

2.4 ROUND DUCTWORK

A. General

1. Factory-fabricated spiral lockseam duct.

a. Except as otherwise indicated.

2. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes.
3. Factory-fabricated fittings:

a. Same manufacturer as duct and as detailed.
b. Same material and construction as duct in which installed.
c. Tees:

1) 45 degree conical tap.
2) Center-line take-off, unless otherwise indicated.
3) Continuously welded seams.

d. Elbows:

1) Continuously welded seams.
2) Mitered elbows:

a) 2 gores - less than 35 degrees.
b) 3 gores - 36 degrees through 71 degrees.
c) 5 gores - over 71 degrees

B. Single-Wall Ducts

1. Construction materials.

a. Galvanized steel: Supply and return, general and toilet exhaust ducts.
b. Type 304 or 316 stainless steel: Dishwasher, shower, laboratory exhaust ducts.
c. Type 3003-H14 aluminum: Dishwasher, shower exhaust ducts.

2. Metal gauges.

a. Comply with Table No. 10-B, UMC-1985.
b. Comply with NFPA 90A when ducts traverse through smoke zones.

3. Similar to United McGill "Uni-Form."

C. Factory-fabricated Accessories.

1. Couplings.
2. Volume dampers.
3. Bellmouth fittings.
4. End caps.
5. Angle rings.
6. Insulation ends:

a. Connection of double to single wall ducts.

7. Terminal outlets.
8. Access doors:

a. Standard.
b. Hinged.
c. Framed.
d. Pressure relief.

9. (Others)

D. Dedicated exhaust systems – Hazardous, fume hoods, airborne infection isolation rooms

E. Comply with the following standards, most stringent takes precedence:

1. SMACNA "Round Industrial Duct Construction Standards", latest edition.
2. ACGIH "Industrial Ventilation-A Manual of Recommended Practice", latest edition.
3. UMC Chapter 11 "Ventilation Systems and Product Conveying Systems", 1988.
4. UMC Chapter 19 "Miscellaneous Heat-Producing Appliances", 1988.

2.5 SHEET METAL PLENUMS

A. Construct plenums and equipment casings in accordance with Section 6 of SMACNA standards except that sheet metal shall be 16 gauge minimum throughout.

2.6 MRI CRYOGEN VENT PIPE

A. 304 Stainless steel pipe.

B. Schedule 10 minimum.

C. Continuously welded construction.

D. No longitudinal seam.

PART 3 - EXECUTION

3.1 DUCTWORK INSTALLATION

A. General:

1. Construct with gauges, joints, bracing, reinforcing, and other details per latest UMC, ASHRAE, SMACNA, and NFPA unless specified otherwise.

a. Comply with most stringent.
b. Provide ducts with NFPA 90A gauges when traversing smoke zones.

2. Construct of galvanized sheet metal except where otherwise indicated.
3. Provide for duct rigidity by either of these methods:

a. Cross beading at 12 inches on center, maximum.
b. Provide additional reinforcement if "drumming" or "oil-canning" occurs during fan operation.
c. Diagonally crossbreak all panels on metal rectangular ducts over 18 inches in either direction.
d. Crossbreak outward in ducts having positive internal pressure.
e. Crossbreak inward in ducts having negative internal pressure.

4. Alter duct sizes on basis of equal friction where required to facilitate installation.
5. At exposed duct penetrations of wall, floors, and ceilings, provide sheet metal angle type escutcheons.
6. Tapers:

a. Pitch sides of duct in "diverging" or "converging" airflow maximum of 1 to 4 taper.

7. Duct openings:

a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, etc.
b. Insert through airtight rubber grommets.
c. Provide pitot tube openings where required for testing of systems:
d. Complete with metal cap with spring device or screw to ensure against air leakage.
e. For Pitot tube tests install Ventlok NO. 699 and/or 699-2 instrument test holes.
f. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring of ruse as plug.
g. At fire dampers, allow adequate length of length of duct to install access door.

8. Volume dampers.

a. Install damper where specified in Section 233300 - Air Duct Accessories.
b. Install damper in every branch, except where only one terminal air unit serves only one air device.

9. Ducting: Use galvanized steel sheet for all applications listed except use stainless steel in constructing ductwork for hazardous exhaust systems for hoods and safety cabinets, downstream of operating room final filters, kitchen hood, and dishwasher exhaust systems. Stainless steel duct shall be provided for all duct mounted humidifiers extending ten feet or the absorption length required if greater than ten feet, downstream of humidifier. Provide kitchen hood exhaust system per UMC, with California amendments.

B. Elbows and Splits:

1. Use radius elbows in rectangular ducts unless otherwise indicated.

a. Centerline radius not less than 1-1/2 duct width.

2. Where space does not permit duct radius specified above, install short radius splitter vanes per referenced "Standards."

    a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W).

        1) 1 vane: R/W above 0.3.
        2) 2 vanes: R/W between 0.1 and 0.3.
        3) 3 vanes: R/W 0.1 and smaller.

3. Use square turns in rectangular ductwork, unless indicated otherwise, at following locations:

    a. Immediately upstream from supply air outlets.
    b. Where required to facilitate installation.
    c. Do not install on square turn immediately after another.

4. Install turning vanes as specified above in all square turns, unless otherwise indicated.
5. Do not use turning vanes in square turns in rectangular ducts in the following applications:

    a. Fume hood exhaust.

6. Where indicated, provide turning vanes of special size and shape.
7. In high and medium pressure ductwork, spot weld turning vane to duct.
8. Two-way splits:

    a. Supply, return and exhaust.
    b. Two elbows:

        1) Proportionally sized per SMACNA Duct Standards.
        2) Radius or square.

    c. Single fitting acceptable.
    d. With turning vanes.
    e. Duct openings sized as above.

C. Rectangular Duct Joints:

1. Standing seams, except where flush drive slip seam called for such as coils, FSDs, etc.
2. "Ductmate" system joints may be used in lieu of standing seams.
3. Transverse duct connections.

D. Joint Sealing:

1. Seal transverse and longitudinal joints of sheet metal ducts by one of the following methods:

    a. 6-ounce canvas strip, 6 inches wide.
    b. Adhere with lagging adhesive.

c. Hardcast PS-S tape.
d. United Hi-Velocity sealer.
e. Applications as recommended by manufacturer.

2. Seal punched holes and corner cracks.
3. After installation and testing, reseal joints found to be leaking.

E. Outdoor Ducts

1. Make ducts subject to rain watertight.
2. Construct as follows to assure water runoff:

a. Arrange standing seams to not act as dams.
b. Place longitudinal seams at bottom of duct.
c. Slope entire top of duct down toward side.
d. Provide vertical struts within duct to bow top panels of duct into convex shape.
e. Use mastic within sheet metal joints.

F. Sound-Rated Duct Packing

1. Wherever possible, avoid duct penetrations through sound-rated walls, floors, and ceilings, either:

a. Architectural elements or
b. Metal plenum elements provided under this Section

2. Provide packing for unavoidable duct penetrations as follows:

a. (Edit as required by acoustical consultants.)

G. Aluminum Ductwork

1. Aluminum sheets:

a. One gauge heavier than galvanized steel as specified.

2. Joints and seams made watertight by:

a. Soldering.
b. Aluminum welding.
c. Or applying epoxy adhesive.

1) Scotch-Weld Structural Adhesive No. 2216.
2) Apply epoxy adhesive to seams and joints before fabrication.

3. Grilles on aluminum ductwork: aluminum.
4. Separate aluminum ducts, casing, plenums, housings and louvers from direct contact with concrete by resilient gasketing or caulking compound.

H. Stainless Steel Ductwork

1. Stainless steel sheet:

a. Same gauge as galvanized steel as specified.

2. Joints and seams:

a. As specified for low pressure ductwork except as noted otherwise.

I. Sound-Rated Duct Penetration Packing Through.

1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings, either:

a. Architectural elements, or
b. Metal plenum elements provided under this Section.

2. Provide penetration packing as follows:

a. (Edit as required by acoustical consultants.)

3.2 ROUND DUCTWORK

A. Joints between ducts:

1. Made with beaded sleeve joints as scheduled.
2. Duct sealer applied to male end.
3. Mechanically fastened with sheet metal screws or pop rivets.
4. Over joint and screw or rivet heads, apply coating of duct sealer.
5. Cover entire joint with duct tape.

B. Joints, duct and fitting:

1. Slip projecting collar of fittings into duct.

a. Insertion length 2 inches minimum.

2. Apply duct sealer.

a. Seal and tape as specified above.

3. Mechanically fasten.

C. Fastening schedule:

Diameter	End Lap	No. of Rivets in Slip Joint
8 inches	3/4 inch	4
9 to 16 inches	1 inch	6
17 inches and larger	1-1/4 inch	7

D. Junctions between ducts:

1. Branch takeoff: 45 degrees.

2. Branch takeoff: Conical 90 degrees.
3. Branch connections to rectangular ducts may be made with spin-in fittings as specified.

E. Horizontal supports:

1. 1- or 2-piece clamp band strap.
2. Minimum: 1 per section.
3. Support fittings as required to prevent sagging.

F. Vertical Supports: One of the following:

1. Clamp bands with extended ends supported by floor.
2. Clamp bands with knee bracing.
3. Pedestal at base of vertical.

G. Use "c" braces for duct reinforcing.

H. Additional bracing: Per seismic requirements.

3.3 DUCT HANGERS AND SUPPORTS

A. General:

1. Support horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA Duct Construction Standards.
2. Attachment to structure: As specified in Section 230529 – HVAC Piping Supports, Hangers, Guides and Anchors.
3. Vibration isolation for ducts: As specified in Section 230548 – Seismic Controls for HVAC Piping and Equipment.
4. Seismic restraints: As specified in 23 05 29 – HVAC Piping Supports, Hangers, Guides and Anchors.

B. Horizontal Duct Supports:

1. Install hangers at each change in direction of duct.
2. Strap hangers:

   a. Extend strap down both sides of ducts.
   b. Turn under bottom 1 inch minimum.
   c. Metal screw hangers to:

      1) Bottom of duct.
      2) Upper and lower sides of ducts.
      3) Not more than 12 inches on center.

3. Angle hangers:

   a. Provide angle hangers formed by extended vertical bracing angles.
   b. Or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule.

4. Support rectangular fume and grease exhaust ducts on angle hangers.

    a. Do not penetrate duct with fasteners.

5. Support circular fume and grease exhaust ducts with flat bar bands around duct.

    a. 1/4 inch by 2 inch steel.
    b. Hot dipped galvanized after fabrication.
    c. Fasten top to hanger rod.
    d. Bolt bottom of bands.

6. Vertical duct supports:

    a. Support vertical ducts at every floor.
    b. Use angles or channels riveted to ducts.
    c. Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise noted.

3.4 MISCELLANEOUS INSTALLATIONS

A. Install following the equipment and materials furnished under other sections.

1. Balancing dampers.
2. Combination fire/smoke dampers.
3. Control dampers.
4. Filters.
5. Sound traps.
6. Air blenders.
7. Air monitors.
8. Access doors.
9. Duct mounted smoke detectors.

3.5 HUMIDIFIER DUCT DRAINS

A. At low points for moisture collection.

1. 1 inch drain.

    a. Type M copper.

2. S-trap (or P-trap) for water seal.

    a. Minimum depth of trap: 1-1/4 times maximum static pressure differential induct section.

3. Run drain to nearest plumbing drain.

    a. Terminate with 1 inch minimum air gap.

4. Provide tee connection in drain.

a. Between duct and trap.
b. Connection from trap primer under Plumbing Section.

3.6 DUCT PRESSURE TESTING

A. Scope of Pressure Testing:

1. All ductwork pressure testing shall be by the licensed air balance contractor. Test ductwork as scheduled below for leaks.

   a. Pressure testing to include applicable supply, return and/or exhaust plenums.

2. Apply positive pressure test to all ducts intended to operate under positive pressure, such as:

   a. Supply ducts from fans to air terminal units.
   b. All supply ductwork in shafts.

3. Return/exhaust ductwork testing:

   a. Dedicated exhaust systems such as kitchen hood exhaust, hazardous waste, etc. shall be tested full length of system from inlet to fan. Testing in sections acceptable before final test.
   b. All return and exhaust ductwork concealed in shafts.

B. General:

1. Use portable high pressure blower and necessary instruments.

   a. Provide duct connections required for air flow and pressure testing.

2. Conduct tests as follows and as recommended in SMACNA balancing manual.

   a. See Section 230593 – Testing, Adjusting and Balancing for HVAC.

3. Test before sections are concealed.
4. Furnish signed reports of results of tests to Architect.
5. Test Pressures:

   a. Per SMACNA Standards.

6. The following are required above SMACNA Standards. Apply negative pressure test to all ducts intended to operate under negative pressure, such as:

   a. Return ducts from air intakes to fans. (Not required on portions of duct exposed in spaces served by duct.)
   b. Toilet exhaust ducts from air inlets to fans.
   c. General exhaust ducts from air inlets to fans.
   d. Kitchen exhaust ducts from hoods to fans.
   e. Dishwasher exhaust ducts from hoods to fans.

f. Fume hood exhausts from cabinets or hoods to fans.

C. Procedure:

1. Seal openings in ducts and plenums to be tested.
2. Connect test apparatus to test section using flexible duct connections or hose.
3. Close damper on blower suction side, to prevent excessive buildup of pressure.
4. Start blower and gradually open damper on suction side of blower.
5. Test for audible air leaks in ducts and plenums per referenced standards.

   a. Repair all audible leaks.
   b. Do not retest until sealants have set.

6. Test for rate of air leakage in ducts and plenums per referenced standards.

   a. Determine amount of air leakage by makeup air flow measurements.

7. Repair air leaks as required and retest.
8. Visually mark tested sections with certification sticker and initials of field test inspector.

D. Total duct leakage allowable:

1. Per seal class specified above and defined by SMACNA Duct Construction Standard.
2. Leakage class shall be from Table 4-1 of SMACNA HVAC Air Duct Leakage Test Manual:

   a. ½ inch, 1 inch, 2 inch W.G., Seal Class C, Leakage Class 24 (rectangular) and 12 (round).
   b. 3 inch W.G., Seal Class B, Leakage Class 12 (rectangular) and 6 (round).
   c. 4 inch, 6 inch, 10 inch W.G., Seal Class A, Leakage Class 6 (rectangular) and 3 (round).

3.7 DUCT CLEANLINESS

A. Adhere to duct cleanliness standards as described in SMACNA "Duct Cleanliness for New Construction" guidelines. Advanced level (level C) guidelines shall be followed including instructions for delivery of ductwork, installation, protection of risers, access provisions, site storage and production.

B. All ductwork is to be sealed at delivery, during staging, and at workday completion.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes dampers, fire dampers, smoke dampers, combination fire/smoke dampers, sound attenuators, access doors, and flexible connections used in duct systems.

1.2 QUALITY ASSURANCE

A. Construct and test fire dampers in accordance with UL Standard 555. Each fire damper shall have a 1-1/2 or 3 hour UL fire protection rating, as required, and shall include a UL label in accordance with established UL labeling procedures. Fire dampers shall be State Fire Marshal listed.

B. Construct fire damper fusible links to UL Standard 33, Fusible Links for Fire Protection Service, for service intended.

C. Smoke dampers and combination smoke/fire dampers shall be classified by UL as a leakage rated damper for use in smoke control systems, under UL 555 S, and shall bear a UL label attesting to same and shall be State Fire Marshall listed.

D. Demonstrate resetting of fire dampers to authorities having jurisdiction and Owner's Representative.

E. Match duct accessories materials with duct system materials specified in Section 233113 - HVAC Sheet Metal Ductwork. Metal gauges specified herein may be decreased in accordance with SMACNA standards for stainless steel components.

F. Accessories shall meet the requirements of NFPA 90 A and NFPA 101, as applicable. Fire and fire/smoke dampers shall be approved by the State Fire Marshal.

G. Fabricate in accordance with ASHRAE Handbooks and SMACNA duct manuals.

1.3 SUBMITTALS

A. Provide submittals in accordance with provisions of Section 013300 - Submittals.

B. Submit shop drawings of factory fabricated assemblies.

C. Submit manufacturer's printed installation instructions.

D. Provide a field mock-up smoke damper installation complete with wall framing, wallboard, wall opening filler pieces, perimeter mounting angles, sleeve, breakaway duct connections, and duct smoke detector access door. Obtain Architect's approval of mockup prior to starting damper installation.

E. Provide a field mockup of proposed contractor fabricated balancing dampers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire Dampers:

1. Ruskin
2. Air Balance
3. Phillips-Aire
4. Greenheck

B. Combination Fire/Smoke Dampers:

1. Ruskin
2. Air Balance
3. Phillips-Aire
4. Greenheck

C. Balancing Dampers:

1. Air Balance
2. Phillips-Aire
3. McGill

D. Backdraft Damper/Barometric Pressure Relief Damper:

1. Greenheck
2. Air Balance
3. Ruskin

E. Access Doors - Ductwork:

1. Ruskin
2. Ventfabrics, Inc

F. Sound Attenuators:

1. Industrial Acoustics
2. Vibro Acoustics

G. Control Damper:

1. Ruskin
2. Air Balance

2.2 ACCESS DOORS - DUCTWORK

A. Construction: Close fitting rigid galvanized steel assemblies with sealing gaskets. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.

B. Provide access doors a minimum of 12 inches by 12 inches in size, fabricated of the same material, finish and gauge as the ductwork in which installed, unless otherwise shown or required.

1. Insulated ducts:

a. Provide hollow metal doors of thickness to match insulation, fabricated from a minimum of No. 20-gauge sheet metal.
b. Design lock edge of doors with a bevel of 1/8-inch in 1-inch and fill interior hollow space with insulation, thermally equivalent to the ductwork insulation. Lap inner face of door over duct opening, a minimum of 1/4-inches on all four edges of the free duct opening.
c. Frame duct opening for each door with a continuous 1-inch by 1-inch by No. 12 gauge sheet metal angle, of the same material as the duct in which installed, riveted to the exterior surface of the duct opening.
d. Provide each door with minimum of 2 butt hinges and a surface type latch with inside striker for contacting inside of door framing, so as to provide a compression fit. Provide doors over 24-inch high with minimum of 3 hinges and 2 latches.
e. Provide all doors with a 3/4-inch wide sponge rubber or felt gasket, around all four sides of duct opening.

C. Provide doors for access to items in ducts and plenums requiring inspection, maintenance, and adjustment.

D. Provide doors for access to duct smoke detector sat air handling equipment of duct detector sampling tubes.

E. Wherever possible, install doors so that air pressure differential tends to keep door closed.

F. Locking Devices: Provide 2 Hinges And 2 Sash Locks For Sizes Up To 18 Inches Square; 2 Hinges And 2 Compression Latches With Outside And Inside Handles For Sizes Up To 24 Inches X 48 Inches. Provide An Additional Hinge For Larger Sizes.

2.3 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Permanently mark dampers for use in [static] [dynamic] systems.

B. Ceiling Dampers: Galvanized steel, 22 gauge frame and 16 gauge flap, two layers 0.125-inch ceramic fiber on top side [, and one layer on bottom side for round flaps], with locking clip.

C. Horizontal Dampers: Galvanized steel, 22 gauge frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for [closure under airflow conditions]. Configure with blades out of air stream except for 1.0-inch pressure class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x ½-inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.4 COMBINATION FIRE/SMOKE DAMPERS

A. General:

1. Provide Ruskin combination fire/smoke dampers at fire rated/smoke partitions and walls in accordance with NFPA 90 A and NFPA 101. Refer to Drawings and diagrams.
2. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL 555 S, and further classified by Underwriter's Laboratories as a leakage rated damper for use in smoke control systems under the latest version of UL 555 S, and bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes. Having a single damper size tested and UL qualified is not acceptable. The leakage rating under UL 555 S shall be no higher than Leakage Class II (10 CFM/sq ft at 1 inch wg).
3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operating conditions, with pressures of at least 4 inches wg in the closed position, and 3500 fpm air velocity in the open position.
4. Dampers and their operators shall be qualified under UL 555 S to an elevated temperature of 250 degrees F with pneumatic operators. Operators shall be installed by the damper manufacturer at time of fabrication. The assembly shall meet UL 555 S qualifications for dampers and operators.
5. Provide electric motor operated, 115-volt, single phase. Provide dual indicating switch for indication of full open and full closed position. Provide spring-return, fail closed type operators that close damper upon power interruption. Damper operators shall be UL listed as fire damper operators, and shall bear the appropriate UL operator label.
6. Provide damper limit switches for monitoring purposes.
7. Provide each combination fire/smoke damper with a 20 factory steel mounting angles of length and gauge required for satisfactory installation, with damper operator and limit switch factory within the sleeve and properly linked to damper operating shaft. Mount operator and switch inside the duct and outside of the fire wall to prevent interference with rated installation retaining angles.
8. Equip each combination fire/smoke damper with a fusible link and switch package.
9. At smoke-rated partitions, a smoke detector shall be furnished under Division 26.

10. Provide stainless steel fire/smoke dampers where required at stainless steel ductwork.
11. Fire smoke dampers are to be provided with disconnect switch to meet requirements of CMC section 309.0.

B. Rectangular Dampers Located at Main Shaft Areas:

1. Provide airfoil-shaped, Model FSD60, Leakage Class I, double skin blades, with 14 gauge equivalent thickness, maximum 6 inches wide, having shafts/bearings designed to meet temperature requirements. Provide 5 inches by 16 gauge galvanized channel frame. Seal blade edges with silicone rubber and jamb with flexible metal compression.
2. The pressure drop for 24 inches by 24 inches damper handling 8500 CFM shall be 0.08 inch wg or less under standard air conditions.
3. Dampers shall be Ruskin FSD60 with UL 555S, Leakage Class I, and fuse link and switch package.
4. For duct velocities over 2000fpm.

C. Round Dampers Located in the Ductwork:

1. Construct dampers similar to rectangular dampers except with sleeve and connection for round ducts.
2. Dampers shall be Ruskin Model FSDR25, UL555S Leakage Class I.
3. Silicone rubber sandwiched between two blade pieces.
4. 1/2 inch diameter axle.
5. Stainless steel sleeve bearings pressed into frame.
6. Z piece galvanized steel blade equivalent to 14ga. thickness.
7. Firestat for remote monitoring includes indicating switches.
8. For duct velocities below 2000 fpm.

D. Rectangular Dampers Located in the Ductwork:

1. Dampers shall be Ruskin Model FSD36, UL555S, Leakage Class II.
2. Silicone blade edge seals
3. Flexible stainless steel jamb seals.
4. Stainless steel bearings pressed into frame.
5. Firestat for remote monitoring includes end switches.
6. For duct velocities below 2000 fpm.

2.5 BALANCING DAMPERS

A. General:

1. Provide dampers throughout the duct systems to facilitate complete balancing.
2. Provide anodized aluminum dampers on anodized aluminum duct.

B. Rectangular Dampers with either width or height dimension less than 24 inches:

1. Butterfly type dampers with 18 gauge galvanized steel or duct casing angle reinforced as required.

2. Provide single thickness 16 gauge minimum, galvanized steel blades, welded or bolted to 1/2 inches minimum diameter through shaft. Permanently mark end of shaft to indicate blade position and fit with a locking quadrant mounted on outside of frame. Bearings shall be pressed into frame and designed for dynamic requirements.

C. Rectangular Dampers with both width and height dimensions greater than 24 inches:

1. Frame, 5 inches by 1 inch, 16 gauge galvanized steel channel. Blades, 8 inches maximum width, 16 gauge galvanized steel, opposed blade, having shafts/bearings designed to meet dynamic requirements, positively locked to shafts.
2. Control shaft shall be 3/8 inch square, plated steel, permanently marked to indicate blade position, and fitted with locking quadrant mounted on outside of frame.
3. Pressure drop for a 28 inches by 28 inches damper handling 7600 CFM shall be 0.05 inch wg or less under standard air conditions.
4. Dampers shall be Johnson SD-1500.

D. Round Dampers Up to 24 inches Diameter:

1. Frame shall be 18 gauge galvanized steel, or duct casing reinforced.
2. Provide single thickness 16 gauge galvanized steel blades, welded or permanently bolted to 1/2 inch minimum diameter through shaft. Permanently mark end of shaft to indicate blade position and fit with a locking quadrant mounted on outside of frame. Bearings shall be pressed into frame and designed for dynamic requirements.

E. Identification: Provide 1-inch wide nylon ribbon for each damper, color as follows: supply air, red; return air, blue; exhaust air, yellow. Tie through hole at end of damper quadrant, leaving at least 12 inches of ribbon hanging free. Attach ribbons at the time each damper is installed.

2.6 DAMPER REGULATORS

A. At accessible dampers, provide locking quadrant operators, Ventlok, Ventfabrics, Inc., Young.

1. Shaft length 12-inch or less: No. 620.
2. Shaft length 13-inch to 20-inch: No. 635.
3. Shaft length 20-inch to 36-inch: No. 641

B. At inaccessible dampers, provide remote operators Ventlok No. 666 or 677, Ventfabrics, Inc, or Young. Provide Ventlok No. 680, Ventfabrics, Young miter gear assembly for dampers operated from 90-degree position. Provide all other necessary rods and linkages to complete the installation. Provide ribbons for ease in location.

2.7 BACKDRAFT DAMPERS

A. Gravity backdraft dampers, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction

B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of 16-gauge galvanized steel or extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90-degree stop, steel ball bearings and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure. Provide Ruskin, American Warming and Ventilation.

C. Barometric backdraft dampers: damper shall be equipped with pressure activated vinyl blade seals and internal plated steel blade-to-blade linkage with blade mounted counterbalance weights.

D. The air handling fan isolation dampers are to be supplied and installed by the air handler manufacturer including the actuator.

2.8 SOUND ATTENUATORS

A. Sound Attenuators: Construct in accordance with NFPA 90A standards. Provide outer casings and internal perforated sheet metal not less than 22 gauge and comply with high velocity ductwork recommendations of the current ASHRAE Guide.

B. Acoustical Fill Materials: Acoustical quality glass fiber packed behind partitions to eliminate voids caused by material settling. Provide airtight construction, leakproof against a differential pressure of 8 inches wg.

C. Packless Type: Silencers constructed entirely of galvanized steel in accordance with ASHRAE guide recommendations for high pressure rectangular ductwork. Seams shall be lock formed. No sound absorptive material of any kind shall be used and silencers shall attenuate air/gas transmitted noise solely by virtue of controlled impedance membranes and broadly tuned resonators. Silencers shall not fail when subjected to a differential air pressure of 8 inches wg inside to outside of casing.

D. Losses: Refer to Drawings for minimum insertion loss, maximum static pressure loss, and maximum self-generated noise schedule.

E. Testing: A fully independent testing firm shall provide documentation and test results certifying compliance with specifications herein. Standard module testing shall be conducted in accordance with industry standards. The sound attenuator shall be acoustically tested with metal inlet and outlet duct sections while under the rated air flow conditions. The noise reduction data shall include the effects of flanking paths and vibration transmission. Test results shall be certified by the testing agency and be made available to the Architect for approval. The test results shall include a complete description of test conditions and measurement procedure.

F. Packaging: Sound attenuators shall be blown clean, bagged, and sealed for shipment. Do not remove attenuators from original cartons until ready for installation.

G. Weather Proofing: Sound attenuators shall be provided with weather-proofing for outdoor installation as recommended by device manufacturer.

2.9 CONTROL DAMPER

A. Provide factory fabricated AMCA-rated automatic control dampers of sizes, velocity and pressure classes as required to provide smooth, stable, controllable air flow. Provide parallel or opposed blade dampers as specified and as recommended by manufacturer's sizing techniques. For dampers located near fan outlets, provide dampers rated for fan outlet velocity and closeoff pressure as recommended by damper manufacturer for fan discharge damper service. Control dampers used as smoke dampers shall comply with UL 555S. Control Dampers used as fire dampers shall comply with UL 555.

B. Manufacturers: Ruskin, M&I, Greenheck, or equal.

C. Damper Construction:

1. Damper selection shall comply with UL 555S Maximum Allowable Damper Leakage Classification I, II, III or IV. The class specified will be based on the application requirements.
2. Frames: Galvanized steel, 16-gauge minimum thickness or 6063 T5 Extruded Aluminum Hat Channel, .125-minimum wall thickness, welded or riveted with corner reinforcement.
3. Blades: Stainless steel in lab exhausts where required and 16-gauge galvanized steel or 6063 T5 heavy gauge Extruded Aluminum minimum elsewhere. Maximum blade width shall be 8-inches and maximum length, 48-inches.
4. Axles, Pivot Rods and Control Shafts: 1/2-inch diameter steel minimum, zinc or cadmium plated.
5. Blade Seals: Synthetic elastomeric, mechanically attached, field replaceable. For low leakage applications, 10-CFM/SF. (51 L/sq. m) of damper area, at differential pressure of 4-inches wg, Classification I, provide inflatable seal edging or replaceable rubber seals rated for specified leakage.
6. Jamb Seals: Stainless steel, spring loaded.
7. Bearings: Bronze sleeve, nylon or ball. Thrust washers at bearings at each end of every blade. Maximum spacing: 48-inch.
8. Linkage: Provide concealed linkage in frame or side linkage out of air stream if available. Otherwise provide face linkage.
9. Temperature Limits: -40- to 200-degrees F.
10. Where opening size is larger than 48-inches wide, or 72-inches high, provide dampers in multiple sections, with appropriately intermediate frames, and jackshafts.
11. All dampers to come with required jackshafts, crank arms, and linkages to provide unison operation of multiple sections by a single or multiple actuator configuration.

D. Round and Oval Control Dampers:

1. Shall comply with Heavy-Duty construction. Blade stops shall be 1/2-inch by 1/4-inch minimum full circumference steel bar. Blade seals, where required, shall be full circumference neoprene. Temperature limits: -40- to 250-degrees F.

E. Industrial Control Dampers

1. Ruskin Model CD80AF2, CDR80AF2, CDR90AF2, or CD90AF2 as applicable, Greenheck, M&I, or equal

    a. Frame: 8-inches by 2-inches by minimum 14-gauge

        1) Bolt Holes: Both flanges
        2) Provide structural support where necessary to support the weight of the framed assembly

    b. Blades:

        1) Style: Airfoil-shaped, double-skin.
        2) Action: Opposed Blade
        3) Material: Minimum 16-gauge galvanized steel
        4) Width: 8-inches maximum

    c. Axles: Minimum 3/4-inch diameter plated steel rod.
    d. Bearings: Stainless steel sleeve in cast housing bolted to frame
    e. Linkage: Side linkage out of air stream. Face linkage in air stream. Minimum 3/16-inch by 3/4-inch plated steel tie bars.
    f. Actuator: The first damper shall have manual, hand crank with locking quadrant. This damper shall be used to create the static pressure drop the plenum needs. The second damper shall be modulating 120-seconds full open to close damper which shall modulate in opposition to the increased exhaust volumes. Refer to specification Section 15951DDC EMS Basic Materials & I/F Devices for actuator requirements.
    g. Seals:

        1) Blade: Mechanically attach blade seals to blade. Provide EPDM blade seals, maximum 250-degrees F
        2) Jamb: Compressible stainless steel located between blade edge and jamb.

    h. Finish: Mill galvanized.
    i. Temperature limits: -40- to 250-degrees F
    j. Assembly: Factory assemble damper components.
    k. Performance Data

        1) Maximum System Pressure: 32.0-inches w.g.
        2) Maximum System Velocity: 6,000-feet per minute
        3) Leakage with Seals: Based on pressure differential of 1-inch w.g.

    l. Percent of Maximum Flow: 0.22.
    m. Leakage: 13.0-cubic feet per minute/square foot

        1) Leakage without Seals: Based on pressure differential of 1-inch w.g:

            a) Percent of Maximum Flow: 1.00.
            b) Leakage: 60.0-cubic feet per minute/square foot

        2) Ultra-Low Leakage:

a) Percent of Maximum Flow: 0.16.
b) Leakage: 9.5-cubic feet per minute/square foot

F. Refer to 230923 for damper actuator.

2.10 FLEXIBLE CONNECTIONS

A. Fabricate of neoprene coated flameproof fabric tightly crimped into metal edging strip and attach to ducting and equipment by screws or bolts at 6 inches intervals. Flexible duct connections shall be provided with a sufficient material width to prevent interference with free operation of fan vibration isolation systems.

2.11 BIRD SCREENS

A. Aluminum Bird Screen shall be minimum 0.050 double crimped aluminum wire in a V2XV2 grid, secured with a heavy extruded channel frame and attached with mechanical fasteners. Bird screen shall be stainless steel for where shown on the drawing.

2.12 DRIP PANS

A. 18-gauge, galvanized sheet metal 2-inch deep, solder-jointed, with drain piped to nearest air gap waste, unless specifically shown otherwise. Provide under all coils with fluid under 55-degrees F, including chilled water coils. Extended coil drip pans under coil valving. Provide under all fan coils excluding the one serving basement mechanical room and penthouse. Extend drain full size to over suitable code compliant drain receptacle.

PART 3 - EXECUTION

3.1 APPLICATION

A. Access Doors: Provide for inspection, maintenance and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, smoke dampers, combination fire/smoke dampers, before humidifiers, in humidifier discharge ducts, and duct heating coils. In addition, provide access doors at 50 feet on center in long duct runs to facilitate cleaning. Cleaning access doors shall be labeled as such. Review locations prior to fabrication. Doors shall be square duct width or height; each shall not be smaller than 8 inches x 8 inches or no larger than 24 inches x 24 inches; multiple access doors at certain duct locations may be required in order to achieve this. Ducts over 48-inches in width require multiple doors. Duct shaft take-offs require a minimum of two access doors. Two 20 inches by 20 inches access doors required on ducts 48 inches to 60 inches, and 24 inches by 24 inches multiple doors on ducts over 60 inches. Coordinate bottom or side access as required. Provide 4 inches by 4 inches quick-opening duct access doors for inspection at balancing dampers.

B. Fire Dampers: Provide at locations, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Provide fire dampers complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges. Fire damper units having dampers, sleeves, angles, and breakaway duct connections constructed as an integral unit shall be acceptable if UL labeled as an assembly.

C. Balancing Dampers, Low Pressure: Provide balancing dampers at all points where supply, return, and exhaust systems submains, branch mains, and branches are taken from larger ducts, and as shown in typical details, drawings, and diagrams.

D. Balancing Dampers, Medium and High Pressure: Provide balancing dampers on systems as shown in typical details, drawings, and diagrams. Do not use splitter dampers except where specifically indicated on Drawings.

E. Flexible Connections: Provide immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration. In addition, provide flexible connections where ductwork crosses building expansion joints and where ductwork crosses separations between new and existing construction.

3.2 INSTALLATION

A. Install items in accordance with manufacturer's printed instructions and SMACNA standards.

B. Sound attenuators shall be installed as shown on Drawings and supported from structural members in accordance with manufacturer's recommendations. No rigid connection shall exist between sound attenuators and partitions, walls, ceilings, etc.

C. For connections to medium and high-pressure fans, install 1/8-inch thick neoprene pad over fabric and hold in place with additional metal strips.

D. Locate duct access doors for easy access. Locate doors above accessible ceilings whenever possible. Coordinate locations of ceiling access doors with ceiling installer and with other trades such that conduit and pipe does not prevent or interfere with access to ductwork. Refer to Section 230500 – Basic HVAC Requirements, for access door requirements in ceilings and walls.

E. Install fire dampers, smoke dampers, and combination fire/smoke dampers (FSDs) in accordance with manufacturer's printed installation instructions including provisions for any supplementary framing and blocking of metal or wood studs in drywall partitions. Coordinate requirements for this work with Division 9. Placement of framing units shall remain work of Division 9. Disconnect switch is to be provided to meet the requirements of CMC Section 309.0, installation and wiring under Division 26.

F. Install duct mounted smoke detectors, supplied under Division 26, in ducts upstream of associated smoke damper and fire/smoke dampers per manufacturer's printed installation. Assure the minimum air velocity at the sampling tube location per manufacturer's recommendation. Provide duct box assembly (tapered enlargement of duct) where required to accommodate mounting of sampling tubes

G. Provide all necessary accessories, devices, mounting plates required to mount smoke detectors.

H. Install duct airflow stations in locations shown on Drawings and comply with manufacturer's installation instructions.

I. Mount damper operators, control devices, thermometers, and gauges upon extension brackets or devices to prevent interference with insulation or vapor barrier integrity.

J. Volume dampers are required at all branch and sub-main exhaust or return ducts regardless if not shown on plans. Include at junction of main ducts at roof.

END OF SECTION 233300

SECTION 233600 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes single duct terminal units, suitable for variable or constant volume applications complete with reheat coil and control devices and other accessories.

1.2 QUALITY ASSURANCE

A. Adhesive and insulation materials shall have a composite fire and smoke hazard rating maximum 25 for flame spread and 50 for smoke developed per ASTM E 84. Adhesives shall be waterproof.

B. Applicable standards of UL-181, ARI, NFPA 90A, ASTM C665 and AMCA.

1.3 SUBMITTALS

A. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

1. Include directions for resetting volume regulators in operating instructions, unless volume regulators are specified to be furnished under other sections of work.
2. Submit detailed unit schedule. Indicate unit number, cfm, gpm, BTU, EAT, LAT, EWT, LWT, allowable cfm range, pressure drop, inlet configuration, and location. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands and inlet pressures of 1 inch to 2 inches wg.

PART 2 - PRODUCTS

2.1 SINGLE DUCT TERMINAL UNITS

A. Manufacturers:

1. Titus
2. Anemostat
3. Krueger
4. Or equal

B. Construction: The terminal casing shall be minimum 22 gauge galvanized steel. The discharge connection shall be slip-and-drive construction for attachment to metal ductwork. The casing shall be constructed to hold leakage to a maximum of 7 CFM total for a typical size 16 unit tested at 1.5 inches differential static pressure.

C. Insulation:

1. Liner type 1 Titus Steri – Loc., or equal Hospital Sensitive Areas includes, Cath Lab control and equipment rooms and spaces outlined in CMC Table 315 and other sensitive type spaces including operating rooms, delivery rooms, recovery rooms, nureries, intensive care rooms, angiography, procedure rooms, isolation rooms, negative pressure treatment rooms, cath labs, Stereotaxis cath labs etc: terminal boxes serving these spaces shall be in compliance with CMC 605.1. Non-porus skin with heavy foil-faced smooth surface adjacent to air stream-All insulations edges are terminated with foil facing fold and secured with full seam galvanized steel z-strips. Insualtion shall be rigid compressed glass fibers with, four pounds/cubic foot density, with a 204 R-value, meeting requirements of UL – 181, NFPA 90A, and ASTM C665. Liners made of mylar, TedlarSilane or woven fiberglass are not acceptable. Lining shall be OSHPD approved.
2. Liner – type 2 – Titus EPFI (engineered polymer foam insulation) or equal. Hospital General Areas. : Fiber free non-porous insulation constructed of Imcoa EPFI with white color finish. Insulation thickness shall meet the requirements of T-24. Insulation shall meet the requirements of UL – 181 and NFPA 90A, NFA 255 (25/50). Thermal conductivity rating of 0.25 BTU-in/hr ft2 @75°F. Lining shall be OSHPD approved.

D. Inlet sensor: Multi-point, center-averaging flow cross-inlet velocity sensor with two amplifying pressure pickup points. The sensor shall amplify the duct velocity pressure by a factor of 1.75, maintaining control accuracy in any configuration, and shall be compatible with local terminal pneumatic or DDC controller.

E. Damper: Heavy gauge steel with shaft rotating in Delrin or self-lubricating bearings. The shaft shall be permanently marked on the end to indicate damper position. Damper shall incorporate a mechanical stop to prevent overstroking, and a synthetic seal to limit close-off leakage to a maximum of 5 CFM for a size 16 unit tested at 1.5 inches static pressure.

F. Heating coils: Hot water reheat coils shall be factory installed on the terminal discharge where indicated. Fins shall be heavy gauge rippled aluminum mechanically bonded to minimum .016 inch copper tubes. Tubes shall have male solder header connections. Coils shall be leak tested to 300 psi, with minimum burst pressure of 2000 psi at ambient temperature. Number of coil rows and circuits shall be as scheduled or as required to provide performance as indicated. Coil performance data shall be based on tests run in accordance with ARI Standard 410. Access panels shall be provided as an integral part of the terminal unit to enable cleaning of the inlet side of the coil.

G. Sound attenuator: Each box shall be constructed with integral factory attenuator insulation shall be identical to that as specified for the terminal unit.

H. Protection: Contractor to Cap openings on terminal units, and maintain in sealed condition at the job site until installation.

I. Control devices: Direct digital control (DDC) controllers will be provided as part of the terminal air unit. All other control devices to be field mounted by the Controls Contractor.

J. Control Parameters: Fully pressure independent constant volume or variable volume type with factory preset maximum and minimum flow rates, field adjustable.

K. Unit Operation: Terminal units shall control airflow rate based upon thermostat demand from minimum static pressure from 0.40 inches SP up to 2 inches SR within plus 5 percent of control volume. Unit inlets shall operate to limit volume variations due to inlet duct configurations to a minimal deviation with the flexible inlet duct bent at 90 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide 3 duct diameters of straight run upstream of terminal units.

B. For ceiling access to units, provide access doors or locate above easily removable ceiling components.

C. Support units individually from the structure. Do not support from adjacent ductwork.

D. Seismically brace as shown on Drawings. If seismic bracing not shown, use OSHPD pre-approved SMACNA or NUSIG details.

END OF SECTION 233600

SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes outlets, inlets, grilles and diffusers. associated with air distribution systems

B. The products specified in this section are part of the Owner's Standardization Program which includes a National Purchase Agreement NPA with TITUS.

1.2 QUALitY ASSURANCE

A. ACC 1062 - Certification, Rating and Test Manual.

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.

C. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

D. ARI 650 - Air Outlets and Inlets.

E. ASHRAE 70 - Method of Testing for Rating and Air Flow Performance of Outlets and Inlets.

F. SMACNA - Low Pressure Duct Construction Standard.

G. Make air flow tests and sound level measurements in accordance with ARI 650, ASHRAE 70, ISO Standard 5219, ISO Standard 3741, and ANSI/ASHRAE Standard 70-1991.

H. Manufacturer shall certify cataloged performances and ensure correct application of air device types.

1.3 SUBMITTALS

A. Provide submittals in accordance with provisions of Section 013000 – Submittals.

B. Submit product data and shop drawings covering each item together with schedule of air devices indicating type, neck size, frame size, sound ratings, mounting type, finish, material, all components, application and noise level.

C. Submit manufacturer's installation instructions.

1.4 COORDINATION

A. Review requirements of air devices as to neck size, frame size, finish, and type of mounting prior to submitting shop drawings and air device schedules.

B. Check location of outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

1.5 ORDERING iNFORMATION

A. Normal standard lead time for shipment of equipment is approximately six (6) weeks from date of order entry.

B. Expedited shipment (10 working days) and local warehouse stock available at additional premium.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Unless otherwise noted, provide all air devices equipped with volume control dampers, adjustable from the air device face.

B. For those supply air devices which are surface-mounted, provide sponge rubber seal around edges.

C. Provide adjustable pattern devices. When not applicable, provide baffles to direct air away from walls, columns, or other obstructions within radius of diffuser operation.

D. Provide air device frames compatible with adjacent finish surfaces involved. Refer to Drawings and reflected ceiling plans.

1. In Modular Ceilings: Snap-in T-bar, inverted T-bar or spline type as required. Refer to Architectural drawings for mounting details.
2. For Perforated Face Devices in Hard Ceilings: Curved, surface-mounted. Refer to Architectural drawings for mounting details.
3. For all other devices in Hard Ceilings or Walls. Refer to Architectural drawings for mounting details.
4. Diffusers in Rough-textured Ceilings such as acoustical plaster: Provide anti-smudge frames, or refer to Architectural drawings for mounting details.
5. Devices in plaster surfaces: Provide plaster frames, or refer to Architectural drawings for mounting details.

E. Performance: Data shall be obtained from tests conducted in accordance with ISO Standard 5219, ISO Standard 3741, and ANSI/ASHRAE Standard 70-1991. Sound NC ratings of air devices shall be based on a room absorption of 10db, re 10-12 watts.

F. Performance: Refer to Drawings for air device types, sizes, and capacities.

2.2 CEILING DIFFUSERS AND GRILLES

A. Ceiling diffusers and grilles shall be aluminum or steel as scheduled, unless otherwise indicated, and furnished with frame type appropriate to installation.

B. Ceiling diffuser and grille models, sizes and finishes shall be as shown on drawings and/or as scheduled. Unless noted otherwise, diffusers shall have baked enamel finish with color selected by Architect.

C. Perforated face ceiling diffusers shall have field adjustable pattern controllers accessible through removable or hinged faceplate.

D. Unless otherwise indicated, interior of perforated face diffusers and grilles shall be finished in flat black.

E. Square plague architectural ceiling diffusers shall have the face panel constructed from 22-gauge steel. The back pan works with the formed edges of the face panel to deliver a uniform 360 degree horizontal air pattern. Unless otherwise indicated, furnish ceiling diffusers and grilles with round neck inlets. Provide directional blow clips to direct the air blow to 2-way or 3-way as shown on the drawing.

2.3 SIDE WALL REGISTERS AND GRILLES

A. Registers and grilles shall be aluminum or steel as scheduled, unless otherwise indicated, and furnished with frame type appropriate to installation.

B. Supply registers shall be double deflection type blades to provide for air deflection adjustment in all directions. Front blades parallel to the long (horizontal) dimension and rear blades parallel to the short (vertical) dimension. Blade spacing ¾ inches, all blades individually adjustable. Provide with opposed volume damper where indicated.

C. Return and exhaust grilles shall have fixed blade core.

D. Register and grille models, sizes and finishes shall be as shown on drawings and/or as scheduled. Unless noted otherwise, register and grilles shall have baked enamel finish with color selected by Architect.

2.4 LAMINAR FLOW DIFFUSERS

A. Laminar Flow Supply Outlets with Integral High Efficiency Filters

1. Titus Model TLF-AA, laminar flow diffusers with replaceable filters of the sizes and capacities and filter efficiencies indicated on the Drawings and Schedules.
2. Diffuser shall consist of a ceiling mounting frame, hanger brackets, perforated face, airtight filter housing, remote operated volume damper, inlet diffusion basket and replaceable, high-efficiency filter.
3. Continuous painted aluminum and plated steel.

4. Extruded aluminum border for gasketed T-bar or plaster ceilings. Border shall incorporate an integral, knife-edge flange for penetrating filter frame silicone gel seal.
5. Perforated face plate and filter housing shall be 0.040 inch aluminum.

    a. Face plate shall be installed in a mounting frame with mitered continuous welded and staked corners.
    b. Face plate shall open with quarter-turn fasteners and safety cable for damper adjustment and cleaning.

6. Filter housing shall be sealed airtight at joints and corners. Inlet collar shall be sealed to the top of the housing. Fit with static pressure port to allow measurement of filter pressure drop. Factory seal and test to assure leakage is consistent with the filter.
7. Damper shall be full-flow type and located in inlet collar. A remote cable operator shall allow damper adjustment while the filter is in place.
8. Filter shall be a 2-inch thick separator-less element in a 3-inch deep anodized aluminum frame. The filter shall have an integral cavity filled with a silicone gel that shall provide a leak-tight seal between the filter frame and border.
9. Border, perforated face, filter housing and volume damper shall have sterile, white, thermal setting finish that shall withstand high concentration cleaning solutions and agents.

B. Titus Model TLF-AA, aluminum laminar flow diffuser with replaceable high efficiency filters (HEPA or ULPA as scheduled).

C. Continuous welded aluminum frame, separate top and bottom plenums separated by solid plate.

D. 14 gauge perforated aluminum face-plate with face-accessible volume damper where required for balancing.

E. Include filter rack with gel seal and filter clips.

2.5 ACCEPTABLE MANUFACTURERS

A. Titus

B. Air Factor

C. Krudger

D. Price

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers and grilles as shown on drawings and in accordance with manufacturer's instructions.

B. Seal connections between ductwork drops and diffusers/registers/grilles air tight.

C. Paint ductwork visible behind air outlets matte black.

D. Provide slack wires, cables, and other support devices as required to comply with State of California codes.

E. Registers and Grilles Installed in Exposed Ductwork:

1. Frames are not required for registers and grilles installed directly in exposed ductwork.
2. Cut and form openings in ducts, so that there shall be a double thickness of metal, to attach the registers or grilles to the ductwork, with sheet metal screws. Bend back edges of the openings into the duct, on all four sides, a minimum of 1-inch to provide the thickness of metal stated above. Provide felt or sponge rubber gasketing, all four sides of duct openings, for supply grilles and supply registers.

F. Air Diffusers Installed in Exposed Ductwork:

1. Frames are not required for registers and grilles installed directly in exposed ductwork.
2. Cut and form openings in ducts, to accommodate the specified volume control damper and adjustable equalizing grid assembly. Reinforce opening as required. Provide felt or sponge rubber gasketing, around duct opening, for supply diffuser assemblies.

G. Provide aluminum diffuser and return grilles for MRI room.

END OF SECTION 233713

SECTION 236423 - SCROLL WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Packaged, air-cooled, electric-motor-driven, scroll water chillers.

1.3 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

C. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 506/110 and referenced to ARI standard rating conditions.

D. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

E. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 506/110 and intended for operating conditions other than the ARI standard rating conditions.

1.4 PERFORMANCE REQUIREMENTS

A. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

B. Performance Tolerance: Comply with the following in lieu of ARI 506/110:

1. Allowable Capacity Tolerance: Zero percent.
2. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

1.5 SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

1. Performance at ARI standard conditions and at conditions indicated.
2. Performance at ARI standard unloading conditions.
3. Minimum evaporator flow rate.
4. Refrigerant capacity of water chiller.
5. Oil capacity of water chiller.
6. Fluid capacity of evaporator.
7. Fluid capacity of condenser.
8. Characteristics of safety relief valves.
9. Minimum entering condenser-water temperature.
10. Performance at varying capacity with constant design air temperature. Repeat performance at varying capacity for different air temperatures from design to minimum in 5 deg F increments.

B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Size and location of piping and wiring connections.
5. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

B. Certificates: For certification required in "Quality Assurance" Article.

C. Source quality-control test reports.

D. Startup service reports.

E. Warranty: Sample of special warranty.

F. Submit wiring diagram (with numbered terminal strip) showing BAS interface points as required.

G. Submit complete list of BACnet monitoring and control points (read-write) that will be available via the BAS workstation.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 590 certification program.

B. ARI Rating: Rate air chiller performance according to requirements in ARI 550/590.

C. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.

D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

F. Comply with NFPA 70.

G. Chiller Manufacturer shall provide add alternate pricing for factory testing of one unit of the Engineer's choice to verify specified criteria are met. A blank copy of the testing report is to be include with the submittal. Add alternate shall include cost of travel, lodging and meals.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.

1. Compressor Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED WATER-COOLED WATER CHILLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Multisack
2. Filtrine
3. Drake

B. First named product is the Basis of Design unit (BoD) and is indicated on Schedule and Drawings. If equipment manufactured by a manufacturer other than that scheduled is utilized, then the Contractor shall be responsible for coordinating with the General Contractor and all affected Subcontractors to insure proper provisions for installation of the furnished unit. This coordination shall include, but not limited to, the following:

1. Structural supports for units.
2. Piping size and connection/header location.
3. Electrical power requirements and wire, conduit and overcurrent protection sizes.
4. The Contractor shall be responsible for all costs incurred by the General Contractor, Subcontractors, and Consultants to modify the building provisions to accept the furnished units.

C. General

1. Factory assembled completely wired and internally piped packaged water cooled modular chillers. Each module shall be capable of independent operation. Chiller modules shall be AHRI certified
2. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment on an AHRI certified or 3rd party verified test stand.
3. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge, powder coated steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.
4. Each refrigerant circuit shall consist of an individual compressor, common dual circuit condenser, dual circuit evaporator, thermal expansion valves, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point.

D. Units shall have KW/Ton, IPLV and NPLV efficiency rating not less than specified here. Kw/ton, NPLV and IPLV values indicate the minimum allowable performance of each chiller that the manufacturer shall meet. Manufacturers are welcome to submit superior performing chillers (such as screw chillers).

Output Type	Full Load	Part Load	Part load	Part Load
Percent Load	100	75	50	25
Chiller Capacity	28.8 Tons	23.5 Tons	16.7 Tons	8.7 Tons
KW	32.1 KW	21.5 KW	12.9 KW	5.8 KW

Efficiency KW/Ton	1.113	0.915	0.774	0.664
EER	10.8	13.1	15.5	18.1
COP	3.2	3.8	4.5	5.3

E. Each module shall be supplied with a lightweight aluminum frame with sound reduction panels. Panels are powder coated 20 gauge steel with 1" of fiberglass insulation to reduce sound levels.

F. Chilled Mains: Each module shall include supply and return mains for chilled water. Cut grooved end connections are provided for interconnection to six inch standard (6.625" outside diameter) piping with grooved type couplings. Rolled grooved shall be unacceptable. Water Mains shall be installed such that they are beneath any power or control wiring so as to insure for safe operation in the event of condensation or minor piping leaks.

G. Evaporators: Each evaporator shall be shell and tube type heat exchanger. As an alternate brazed plate heat exchangers are acceptable with back wash capability and cleaning kit. Heat exchangers shall be constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig refrigerant side working pressure and 360 psig water side working pressure. The evaporator heat exchanger shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.

H. Condenser Fan: Each module shall contain dual condenser fans for each refrigerant circuit. These fans shall be multi-blade vane-axial type made of plastic composite material for quiet operation. Fans shall be direct drive at a maximum RPM of 1,150. Fan motors shall all be pressure controlled and suitable for outdoor use. Include Condenser fan shall be controlled by variable frequency drives (VFD's).

I. Isolation valves shall be installed between the heat exchangers and water supply mains for heat exchanger isolation and removal without the requirement to remove a module or shut down the entire chiller allowing for total access to all serviceable components.

J. Compressor: Each module shall contain two hermetic scroll compressors independently circuited and with internal spring isolation mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure manual reset safety cut-outs.

K. Central Control System.

1. Scheduling of the various compressors shall be performed by a microprocessor based control system (Master Controller). A new lead compressor is selected every 24 hours to assure even distribution of compressor run time.
2. The Master Controller shall monitor and report the following on each refrigeration system:

    a. Discharge Pressure Fault
    b. Suction Pressure Fault
    c. Compressor Winding Temperature
    d. Suction Temperature
    e. Evaporator Leaving Chilled Water Temp.

3. The Master Controller shall be powered by the chillers single point power connection and shall monitor and report the following system parameters:

    a. Chilled Water Entering and Leaving Temperature
    b. Hot Water Entering and Leaving Temperature
    c. Condenser water Entering and Leaving Temperature
    d. Chilled Water, Condenser Water and Hot Water Flow Rate

4. An out of tolerance indication from these controls or sensors shall cause a "fault" indication at the Master Controller and shutdown of that compressor with the transfer of load requirements to the next available compressor. In the case of a System Fault the entire Dedicated Heat Recovery Chiller will be shut down. When a fault occurs, the Master Controller shall record conditions at the time of the fault and store the data for recall. This information shall be capable of being recalled through the keypad of the Master Controller and displayed on the Master Controller's 2 line by 40 character back-lit LCD. A history of faults shall be maintained including date and time of day of each fault (up to the last 20 occurrences).
5. Individual monitoring of leaving chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.
6. The control system shall monitor entering and leaving hot and/or chilled water temperatures to determine system load and select the number of compressor circuits required to operate. Response times and set points shall be adjustable. The system shall provide for variable time between compressor sequencing and temperature sensing, so as to optimize the Dedicated Heat Recovery Chiller performance to different existing building loads.
7. The Chiller shall be capable of interfacing to a building automation system. Interface shall be accomplished using an Interoperability Web Portal and shall be capable of communication over BACNet, Modbus or LON.
8. Chiller shall be capable of operation in the event that the Master Controller has lost communication. FRM provides the ability to switch the chiller into manual mode automatically keeping the chiller online until a replacement Master Controller can be provided. FRM includes a power phase monitor per module.

L. Each inlet water header shall incorporate a built in 30-mesh (maximum) in-line strainer system to prevent heat exchanger fouling and accommodate 100% flow filtration with a minimum surface area of 475 sq inches per module.

M. Single Point Power: Chiller shall be equipped with a pre-engineered genuine buss bar electrical system for single point power rated at a 5,000 amp SCCR. Where the equipment size exceeds the amp rating of the buss bar, multiple power connections may be applied. Pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be taken off-line for repair while the rest of the modules continue to operate. Individual power feeds to each module shall be unacceptable.

N. Pump module: Provide a Pump Module of size and capacity indicated on the drawings and schedules. The Pump Module shall be interconnected though the common chiller header system and require no additional water connections. Pump Module shall incorporate dual in-line centrifugal pumps in a Primary/Standby pumping arrangement. Pump starters and controls shall be provided to enable manual selection of lead pump. In addition, in the event of a loss-of-flow failure of the chilled water system, the Pump Module controls shall disable the lead pump and automatically start the standby pump. Module shall be completely factory assembled and tested prior to shipment.

O. Flow switch per module. Integral to each module and powered by the module for individual module proof of flow and flow safety. Modules without independent IFM switches per module are not acceptable alternates.

2.2 REFRIGERATION

A. Refrigerant:

1. Type: R-410
2. Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

B. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.

C. Pressure Relief Device:

1. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to a remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.

2.3 SAFETIES, CONTROLS AND OPERATIONS

A. Dedicated Heat Recovery Chiller safety controls system shall be provided with the unit(minimum) as follows:

1. Low evaporator refrigerant pressure
2. Loss of flow through the evaporator
3. Loss of flow through the condenser
4. High condenser refrigerant pressure
5. High compressor motor temperature
6. Low suction gas temperature
7. Low leaving evaporator water temperature

B. Failure of chiller to start or chiller shutdown due to any of the above safety cutouts shall be annunciated by display of the appropriate diagnostic description at the unit control panel. This annunciation will be in plain English. Alphanumeric codes shall be unacceptable.

C. The chiller shall be furnished with a Master Controller as an integral portion of the chiller control circuitry to provide the following functions:

1. Provide automatic chiller shutdown during periods when the load level decreases below the normal operating requirements of the chiller. Upon an increase in load, the chiller shall automatically restart.
2. Provisions for connection to automatically enable the chiller from a remote energy management system.
3. The control panel shall provide alphanumeric display showing all system parameters in the English language with numeric data in English units.
4. Each module shall contain a slave controller that will allow any module to run in the event of a master controller failure or loss of communication with the master controller via an on/off/manual toggle switch.

D. Normal Chiller Operation

1. When chiller is enabled, the factory supplied Master Controller stages the chiller capacity from minimum to maximum as required by building load.
2. The chiller control system shall respond to Entering Water Temperature and will have an integral reset based on entering water temperature to provide for efficient operation at part-load conditions.

E. Power Phase Monitor

1. Provide a Power Phase Monitor on the incoming power supply to the chiller. This device shall prevent the chiller from operating during periods when the incoming power is unsuitable for proper operation.
2. The Power Phase Monitor shall provide protection against the following conditions:

a. Low Voltage (Brown-Out)
b. Phase Rotation
c. Loss of Phase
d. Phase Imbalance

2.4 SOURCE QUALITY CONTROL

A. Perform functional test of water chillers before shipping.

B. Factory performance test water chillers, before shipping, according to ARI 506/110, "Water Chilling Packages Using the Vapor Compression Cycle."

C. Factory test and inspect evaporator and air-cooled condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.

D. For water chillers located indoors, rate sound power level according to ARI 575 procedure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.

1. Water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. Equipment Mounting:

1. Install water chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC piping and equipment."

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.

D. Install separate devices furnished by manufacturer and not factory installed.

3.3 CONNECTIONS

A. Comply with requirements in Section 232113 Hydronic Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Make connections to water chiller with a union, flange or mechanical coupling.

D. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15.

E. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
7. Verify proper motor rotation.
8. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
9. Verify and record performance of chilled- and condenser-water flow and low-temperature interlocks.
10. Verify and record performance of water chiller protection devices.
11. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers for a minimum of 8 hours. Video record the training sessions.

END OF SECTION 236423

SECTION 238219 – FAN COILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Fan Coils.

1.2 RELATED SECTIONS

A. Section 230500 - Basic HVAC Requirements

B. Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment

C. Section 230530 - Pipe and Pipe Fittings.

D. Section 232116 - Hydronic Piping Specialties

E. Section 230900 - Instrumentation and Controls for HVAC

F. Section 230593 - Testing, Adjusting, and Balancing for HVAC

1.3 QUALITY ASSURANCE

A. AMCA 99 - Standards Handbook

B. AMCA 230 - Field Performance Measurement of Fan Systems

C. AMCA 300 - Reverberant Room Method of Sound Testing of Fans.

D. ARI 410 - Standard for Forced-Circulation Air-cooling and Air Heating Coils.

E. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

F. SMACNA - Low Pressure Duct Construction Standards.

G. ASTM A525: Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.

1.4 SUBMITTALS

A. Clearly define any exceptions to specifications and drawings.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gages and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit sound power levels for both fan outlet and casing radiation at rated capacity. Submit ACMA 300-85 test report for each fan and unit.

F. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

G. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring

1.5 SUBMITTALS

A. Provide submittals in accordance with provisions of Section 013300 – Submittals.

B. Submit the following information:

1. Manufacturer
2. Unit Model: Overall sizes and sections sizes, overall weight, sections weight, point of support weight load.
3. Fan Selection:

    a. Fan type
    b. Wheel type
    c. Class
    d. Arrangement
    e. Size
    f. Air Flow Capacity
    g. Static Pressure
    h. Drive
    i. Motor HP and Fan BHP

4. Cooling Coil Section:

    a. Fin Series
    b. Type
    c. Height
    d. Width
    e. Rows
    f. Capacity (BTU, CFM, GPM)
    g. Air Entering, Dry Bulb and Wet Bulb Temperatures
    h. Air Leaving, Dry Bulb and Wet Bulb Temperatures
    i. Air SP Drop
    j. Water Entering Temperature
    k. Water Leaving Temperature
    l. Water Pressure Drop

5. Unit Casing:

a. Frame and panel construction and materials
b. Insulation data
c. Vibration isolation provision or requirement
d. Access and clearances

6. Connections: Size, Type and Location:

a. Air
b. Chilled Water
c. Drain
d. Power
e. Controls

C. Submit manufacturer's installation instructions.

D. Submit O&M Manuals: Provide all of the above items and include recommendations for unit maintenance. Provide O&M manuals in accordance with provisions of Division 1.

E. As-built drawings shall show total unit configuration in direction of airflow, unit dimensions, and field duct connection details.

F. Product data shall indicate dimensions, weights, coil performance, fan performance, motor electrical characteristics, finishes of materials, filter media, filter sizes, and filter quantities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. International

B. Williams

C. Climate Craft

2.2 GENERAL

A. Provide blow-through direct drive or belt drive hideaway for ducted application or exposed finished cabinet as required in documents.

B. Units shall be complete, prepackaged, prepiped and prewired including fan, coil and filter sections.

2.3 CABINET

A. Continuous galvanized steel base casing and inlet plenum, 1 inch filter frame for back or bottom return air. Baked enamel finish.

B. Provide acoustical cabinet where fan coils are located over office or lab space.

C. Provide stainless steel cabinet with complete marine installations where indicated on drawings.

2.4 FANS AND MOTORS

A. DWDI, forward curved, centrifugal.

B. Statistically and dynamically balanced.

C. Permanent split capacitor type with resilient mount, sleeve bearing with oilers, inherent thermal overload protection with automatic reset.

D. Three-speed motor control switch mounted on fan coil.

2.5 COILS

A. Extended surface plate aluminum fins, staggered 1/2-inch O.D. seamless copper tubes.

2.6 DRAIN PAN

A. Continuous galvanized steel, closed cell insulation, mastic seal, pitch to drain connection.

B. Secondary drain pan with overflow pipe.

2.7 FILTERS

A. 2 inch throwaway for belt driven fan coil applications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's requirements, instructions, shop drawings, and contract requirements.

B. Anchor to structure with seismic restraints and provide seismic calculations in accordance with Section 230548 Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Coordinate fan coil electrical installation with Division 26.

D. Coordinate fan coil controls with Section 230900 Instrumentation and Controls for HVAC.

E. Provide water pipe connections to pre-piped coils in accordance with the manufacturer's requirements.

F. Refer to Section 230800 Paragraph 3.1D.8 for equipment, Paragraph 3.1A and B for Guidelines and Paragraphs 1.2B, C, D and E for Contractor Commissioning Plan, Pre-Functional Checklists, Training Plan and Tool List.

3.2 TRAINING

A. Provide training to Owner's personnel to adjust, operate and maintain fan coils. Refer to 01 79 00 – Demonstration and Training Requirements.

END OF SECTION 238219

SECTION 238413 – STEAM HUMIDIFIERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes humidifiers for applications in ductwork.

1.2 QUALITY ASSURANCE

A. Certify humidifier capacities, pressure drops and selection procedures in accordance with:

1. ARI 610 - Central System Humidifiers.
2. ARI 630 - Selection, Installation and Servicing of Humidifiers.
3. ARI 640 – Standard for Commercial and Industrial Humidifiers

B. Products shall be supported with a parts warranty that ensures the product will be free from defects in materials and workmanship for a period of two years after shipment

1.3 SUBMITTALS

A. Provide submittals in accordance with provisions of Section 013300 - Submittals.

B. Submit manufacturer's installation instructions.

C. Submit manufacturer's descriptive literature, operating instructions, water treatment, and maintenance and repair data.

D. Product Data: Provide catalog data indicating rated capacity, dimensions, duct and service connections, electric nameplate data and wiring diagrams, including power, signal and control wiring.

1.4 COORDINATION

A. Coordinate location and installation of humidifiers in ducts. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation and suitable absorption distances.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Steam Humidifiers:

1. Dri-Steem
2. Pure Humidifiers
3. Armstrong

2.2 GENERAL HUMIDIFIER EQUIPMENT REQUIREMENTS

A. General: Provide humidifiers for applications in ductwork that are the product of a manufacturer regularly engaged in their production and who regularly issues complete catalog data and computer selection program.

B. Electric Service: Unit shall be protected with internal fuses. Incorporate electrical terminals for installation of humidistat, duct high-limit humidistat, interlock to fan or air flow switch.

C. Humidifiers shall meet the ARI 610, 630 and 640 standards.

D. Capacities and accessories shall be as scheduled.

2.3 STEAM HUMIDIFIERS

A. Humidifiers: Provide within various ducts, steam humidifiers which use industrial cold water to produce chemically-free steam for dispersion. Refer to Drawings for capacities. Product shall include factory injection tube, control valve, and controller.

B. Dispersion Method: Provide dispersion method as indicated and locate such that absorption distance does not exceed 6 feet beyond the insertion section. Dispersion method shall be rapid absorption tube bank.

C. Factory mounted, full size display to provide operational status. Display to include a keypad for user interface and adjustment of operational parameters including: Unit output (%), tank water level, modulating control demand status, fault indication, and capability of interface to building management system. BMS shall be able to remotely control and monitor the humidifier.

D. Humidistats: Refer to Section 230900 – Instrumentation and Controls for HVAC.

E. Humidifers shall be provided with factory float and thermostatic condensate trap and pipe line strainer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install with required clearance for service and maintenance.

B. Install per ARI 630.

C. Make connections to humidifiers, including valves, unions, and connections from pans. Provide valves and accessory items as detailed on Drawings.

D. Ensure water humidifier pan and steam tubes are drainable and make drain connections.

E. Distributor(s) shall be sized and installed per manufacturers recommended installation instructions.

F. An air flow switch shall be installed to insure that the humidifier will not operate unless airflow is present.

G. Install steam dispersion distribution tubes and manifold to result in uniform distribution over the entire cross section of the duct or air handling unit air flow area. Coordinate dispersion distribution system location with other components of the HVAC system up-stream and down-stream of the dispersion point to result in uniform distribution and no condensation.

H. Install high limit humidistat in the duct at proper distance from steam dispersion system per manufacturer's recommendations.

I. Support and brace humidifiers and control cabinet to comply with the State of California seismic requirements.

J. For steam humidifiers, provide gate valve and strainer on steam supply, temperature switch and trap assembly on condensate return.

3.2 START-UP INSTRUCTION

A. Provide services of manufacturer's representative to inspect humidifiers after installation is complete and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

B. Provide manufacturer's representative for start-up of humidifiers and for instruction of Owner's operating personnel. Refer to 01 79 00 – Demonstration and Training.

END OF SECTION 238413

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section covers general work of all Sections under Division 26.

B. Provide a complete working electrical installation with all equipment called for in proper operating condition. Documents do not undertake to show or list every item to be provided. When an item not shown or listed is clearly necessary for proper operation of equipment which is shown or listed, provide the item which will allow the system to function properly at no increase in Contract Price.

1.2 REFERENCES

A. The General Conditions, Supplementary Conditions, and applicable portions of Divisions 1 and 26 apply to the work of this Section as if printed herein.

1.3 SUBMITTALS

A. Forward all submittals in related groups. Individual or incomplete submittals are not acceptable.

B. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment.

C. Identify each submittal item by reference to Specification Section paragraph in which item is specified or Drawing and Detail number.

D. Organize submittals in same sequence as they appear in Specification Sections, articles or paragraphs.

E. Shop Drawings shall show physical arrangement, construction details and finishes.

1. Drawings shall be drawn to scale and dimensioned where applicable.
2. Catalog cuts and published material may be included to supplement scale drawings.

F. Internal wiring diagrams of equipment shall show wiring as actually furnished for this project with all optional items clearly identified as included or excluded. Clearly identify external wiring connections. Identify and obliterate superfluous material.

G. Binders: Prepare submittal material in accordance with the following:

1. Insert all literature in standard 3-ring binders for 8-1/2 inch by 11 inch pages with individual tabs. Do not staple literature on different products together.
2. Number all binders on the outside of the cover and indicate the Specification Section. Mark Binder No. 1 Architect's copy and No. 2 Engineer's copy. Both of these binders shall contain original manufacturer's literature.
3. Provide an index with binder. This index shall follow the same sequence as the Specifications.

H. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this Project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item. Submittals shall include, but not be limited to those items listed in individual Sections.

1. Include all physical and performance data, including materials, manufacturer's names, model numbers, weights, sizes, capacities, performance curves, finishes, colors, accessories and all other data required to completely describe equipment and to indicate complete compliance with Specifications and Drawings.
2. Include with complete submittals above, complete, large scale, dimensioned Shop Drawings, certified by manufacturer, of all major equipment and other equipment as directed by Architect.

I. Substitutions: In accordance with Division 1.

J. Resubmittals will be reviewed for compliance with comment made on the original submittal only and should be marked with a resubmittal number and dated.

K. Operating & Maintenance Instructions and Manuals:

1. Subsequent to final completions and testing operations, instruct the Owner's authorized representatives in operation, adjustment and maintenance of electrical plant.
2. Submit three (3) copies of certificate, signed by Owner's Representatives, attesting to their having been instructed.
3. Before Owner's personnel assume operation of systems, submit three (3) sets of operating maintenance manuals. Bind data in vinyl covered loose-leaf binders with title index tabs identifying items therein to include:

    a. Transformers
    b. Lighting Control Systems

4. Provide two (2) full size prints of Record Drawing One-Line Diagram, in metal frame with glass front. Obtain record drawing prints from Architect at Contractor's cost and have prints framed in location as directed.

L. Submit as-built drawings showing actual constructed conditions in accordance with the provisions of Division 1.

1.4 QUALITY ASSURANCE

A. Materials and Systems:

1. Labels: Provide materials listed and labeled by Underwriters Laboratories or testing firm acceptable to authority having jurisdiction, where listing service is normally provided for product.
2. Materials: Provide new and ship to jobsite in original manufacturer's containers or bundles.

B. Workmanship: Arrange work to obtain coordinated installation.

C. Code Compliance: Comply with applicable codes, laws, rules, regulations, and standards of applicable code-enforcing authorities.

D. References and Standards: All materials and equipment shall comply with all applicable standards and requirements of the standards listed below. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules, regulations. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for completeness or clarity.

1. American National Standards Institute (ANSI).
2. Association of Edison Illuminating Companies (AEIC).
3. Insulated Cable Engineers Association (ICEA).
4. Institute of Electrical and Electronics Engineers (IEEE).
5. National Electrical Code (NEC) (NFPA-70, 2014 2005 Edition) with California Amendments (CEC 2013 – California Electrical Code).
6. National Electrical Manufacturer's Association (NEMA).
7. National Fire Protection Association (NFPA).
8. Uniform Building Code (UBC).
9. Underwriters Laboratories, Inc. (UL).
10. California Code of Regulations, Title 24, Part 3 Section E, Title 8 and Title 17 Public Health (CAC).
11. State of California Low-Voltage Electrical Safety Orders (CAL/OSHA).
12. Codes and regulations noted in other Sections in Division 26, applicable State and Local Codes and Ordinances.

E. If any of the requirements of the above are in conflict with one another, or with the requirements of these specifications, the most stringent requirement shall govern.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

1.6 DRAWINGS AND COORDINATION WITH OTHER WORK

A. Drawings:

1. For purposes of clarity, legibility, Drawings are essentially diagrammatic.
2. Exact routing of wiring and locations of outlets, panels, etc., shall be governed by structural conditions, obstructions and existing conditions. Architect reserves right, at no increase in price, to make any reasonable change in locations of electrical items, exposed at ceiling and/or on walls, to group them into orderly relationships and/or increase their utility. Contractor shall verify Architect's requirements in this regard prior to roughing-in.
3. Dimensions, location of doors, partitions, and similar physical features shall be taken from Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the approximate location shown on Electrical Drawings.
4. Mounting heights of brackets, outlets, etc., shall be as required to suit equipment served.
5. Drawings indicate, generally, routes of all branch circuits. All runs to panels are indicated as starting from nearest outlet, pointing in direction of panel. Continue all such circuits to panel as though routes were indicated in their entirety.

B. Coordination:

1. Work out all "tight" conditions involving Work specified in this Division in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings for review, showing all Work in "tight" area. Provide supplementary Drawings and additional Work necessary to overcome "tight" conditions.
2. Differences or disputes concerning coordination, interference or extent of Work between trades shall be decided by Contractor. His decision, if consistent with Contract Documents requirements, shall be final.
3. Coordinate electrical power and control wiring requirements of mechanical and plumbing equipment specified in Divisions 22 and 23.

    a. Where conflict exists between rough-in shown on drawings and that shown or required by equipment to be installed, obtain clarification from Architect and provide rough-in as directed.

4. Provide templates, information and instructions to other trades to properly locate holes and openings to be cut or provided for Electrical Work.

C. Large Scale Layout Drawings: In accordance with requirements of Division 1, prepare large scale detailed layout Drawings showing locations of equipment, conduit runs, panels, and all other elements of electrical systems where required by other Sections of this Division, plus sections of all congested areas to show relative position and spacing of affected elements. All symbols and designations used in preparing record Drawings shall match those used in Contract Drawings.

D. Equipment Rough-In:

1. Rough-in locations shown on Electrical Drawings for equipment furnished by Owner and for equipment specified in other Divisions are approximate only.

    a. Obtain exact rough-in locations from following sources:

1) From shop drawings for Contractor-furnished and installed equipment.
2) From Architect for Owner-furnished Contractor-installed equipment.

2. Verify electrical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Architect and provide as directed.
3. Unless otherwise shown or specified, provide direct raceway and conductor connections from building wiring system to equipment terminals for direct connected equipment which is Contractor furnished and Contractor installed, Owner furnished and Contractor installed.
4. Provide plug-in receptacle cap for cord connected equipment which is Contractor furnished and Contractor installed, Owner furnished and Contractor installed. Provide new cord and cap if required on Owner furnished and Contractor installed equipment.
5. Provide disconnect switches, flush type in finished spaces, where shown or required by code for direct connected equipment.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. New, bearing label of Underwriters Laboratories, or other testing laboratory acceptable to authority having jurisdiction, where labeling exists for the class of equipment.

B. Provide equipment of one manufacturer, alike in appearance and function.

C. For equipment specified by manufacturer's number, include all accessories, controls, etc., listed in catalogue as standard with equipment. Furnish optional or additional accessories as specified.

D. Where no specific make of material or equipment is mentioned, use any product of reputable manufacturer which conforms to requirements of system and other applicable specification sections.

E. Equipment and material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new. Variance from this permitted only with written approval.

F. Provide an authorized representative to constantly supervise Work specified in this Division; check all materials prior to installation for conformance with Drawings, Specifications, and reviewed Shop Drawings.

G. Where noted, certain manufacturers and products must be used per SCVMC standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer's Directions: Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and leveled with supports neatly placed and properly fastened as shown and specified. Provide means of bringing in and installing equipment into position inside building.

C. Conduit Systems:

1. Worked into complete, integrated arrangement with like elements to make Work neat appearing, finished.
2. Run concealed, except as shown or noted otherwise. Where exposed, install parallel with walls or structural elements: vertical runs plumb; horizontal runs level or parallel with structure as appropriate: groups racked together neatly with straight runs and bends both parallel and uniformly spaced.
3. Install as high as practicable to maintain adequate head room shown or required. Coordinate with Work of other trades to achieve proper headroom.
4. Flash and counter-flash all conduits through roof in accordance with requirements of Section 076100 - Flashing and Sheet Metal.
5. Clearance: Do not obstruct spaces required by code in front of electrical equipment, access doors, etc.

D. Penetrations:

1. Pack space between conduit, sleeve in walls with non-combustible materials.
2. Make penetrations through floors water-tight with non-hardening sealant even though concealed within wall or furred space.
3. Make penetrations through any damp-proofed/water-proofed surfaces damp-proof/waterproof by appropriate means to maintain integrity of system penetrated.
4. Seal around penetrations with fireproofing material to maintain integrity of fire rating where occurs.

E. Provide shrouds at light fixtures, electrical panelboards and like items to maintain integrity of rated wall or ceiling construction.

F. Hangers, Supports, Anchors and Chases:

1. Provide complete as required for installation of Electrical Work. Support and/or anchor all equipment and wiring systems to resist gravity and seismic forces in accordance with the requirements of the Building Code and in compliance with conditions stated in the Contract Documents.
2. Supporting components shall be constructed of metal only: no wood or combustible material will be permitted including supports for outlet boxes.
3. Hangers, anchors and supports for conduit runs: As specified.

4. Provide concrete inserts for attachment of hangers; subject to structural engineer's review.
5. Provide anchors for floor and wall mounted equipment.
6. Provide supports for wall mounted equipment.

3.2 PERFORMANCE

A. Excavating and Backfilling:

1. Provide as required for installation of electrical work in accordance with requirements of Division 31 - Earthwork.
2. Provide all necessary shoring, sheeting and pumping.
3. In any asphalt or concrete paved areas, backfill only to subgrade level.

B. Concrete: In accordance with the requirements of Division 03.

C. Sleeves, Chases and Concrete Inserts:

1. Provide sleeves, chases, concrete inserts, anchor bolts, etc., before concrete is poured.
2. Sleeves, chases are prohibited in structural members, except where shown or approved in writing.

D. Cutting and Repairing:

1. Do all cutting, repairing, including structural reinforcing, necessary for Work specified in this Division.
2. Do no cutting or patching without approval. Repair damage done by this cutting equal to original condition in Architect's opinion.

E. Painting: Include surface preparation, priming and finish coating for electrical cabinets, exposed conduit, pull and junction boxes. Refer to Section 099120 – Interior Painting.

3.3 TESTING AND ADJUSTING

A. Furnish all labor and test equipment required for testing specified in this Division.

B. Test panels and branch circuits for grounds or shorts. Repair defective wiring as required.

C. Test each individual circuit at panel for proper operation.

D. Upon completion of Work, make final inspection; operate equipment under normal conditions, to satisfaction of Architect.

E. At completion of Work, provide written certification that all systems are functioning properly without defects.

F. Test all feeders for line-to-ground and line-to-line resistance with a 500 VDC motor driven "Megger". Minimum acceptable resistance is 100 meg-ohms. Schedule all feeders and indicate line-to-ground and line-to-line resistances. Have all tests witnessed by Architect or his authorized representative.

G. Perform testing at a time suitable to the Architect and Owner. Advise the Architect a minimum of two weeks prior to testing so that he can arrange to be present if he desires.

H. Provide for Grounding System: Test for ground currents with all equipment energized. Include ground impedance test by 2 or 3 point fall-of-potential method.

I. Submit six (6) sets of test reports for review.

3.4 CLEANING AND PAINTING

A. Properly prepare Work to be finish painted as specified in Section 099000 – Painting and Coating.

B. Refinish damaged Work supplied with final finish to satisfaction of Architect.

C. After other Work is accomplished, clean exposed conduit, panels (interiors and exteriors), fixtures, equipment and leave in satisfactory condition.

3.5 EQUIPMENT IDENTIFICATION

A. Refer to Section 260553 – Identification for Electrical Systems for equipment identification requirements.

3.6 VOLTAGE CHECK

A. At completion of job, check voltage at several points of utilization on the system which has been installed under this Contract. During test, energize all installed loads.

B. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120-volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Architect and the Owner.

3.7 POWER SYSTEM STUDY

A. General:

1. Short Circuit, Protective Device Evaluation and Protective Device Coordination Studies shall be performed by the switchboard/switchgear manufacturer. Submit studies to Architect prior to receiving final acceptance of distribution equipment Shop Drawings or prior to release of equipment for manufacture. If formal completion of studies may cause delay in equipment manufacture, acceptance from Architect may be obtained for preliminary submittal of sufficient study data to ensure that selection of device ratings and characteristics will be satisfactory. Provide for both normal and emergency systems.
2. Studies shall include all portions of electrical distribution system from primary of service transformers down to and including 480V and 208V distribution system. Normal system connections and those which result in maximum fault condition shall be adequately covered in the study.

B. Short Circuit Study:

1. Perform study with aid of digital computer program in accordance with ANSI C37.5, IEEE Standard 320 and IEEE Standard 141.
2. Include data on power source's short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected and other source impedances.
3. Calculate short circuit momentary duty values and interrupting duty values on the basis of assumed three-phase bolted short circuits at each switchgear bus, switchboard, low voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents and X/R ratios. For each fault location, list the total duty on the bus, as well as the individual contribution from each connected branch, with its respective X/R ratio.
4. Perform protective device evaluation study to determine adequacy of circuit breakers, molded case switches, automatic transfer switches and fuses by tabulating and comparing short circuit ratings of these devices with calculated fault currents. Apply appropriate multiplying factors based on system X/R ratios and protective device rating standards. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Architect's attention.

C. Arc Flash Hazard Analysis:

1. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E-2004, Annex D.
2. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
3. The arc flash hazard analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 KVA where work could be performed on energized parts.
4. Safe working distances shall be based upon calculated arc flash boundary considering an incident energy of 1.2 cal/cm.
5. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

6. The short circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motor to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
7. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must taken into account the changing current contributions, the as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

    a. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
    b. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

8. For each equipment location with a separately enclosed main device, (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for each incident energy and flash protection boundary shall include both the line and load side of the main breaker.
9. When performing incident energy calculations on the line side of the main breaker (as required per above), the line side and the load side of the contributions must be included in the fault calculation.
10. Mis-coordination must ne checked amongst all devices with the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
11. Arc flash calculation shall be based on the actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 Section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during arc flash event, a maximum of clearing time based on the specific location shall be utilized.

D. Coordination Study:

1. Perform study with the aid of digital computer program, SKM's Captor or equal (no known equal).
2. Include all system protective devices from substation relays feeding the building down to distribution panelboard branch circuit breakers.
3. Plot device curves on log-log paper, grouping appropriate devices together.
4. Study shall show selective coordination so that the device closest to the fault will trip before any other device trips. Recommend settings of devices to achieve this coordination.

E. Ground Fault Study: Provide short circuit study which shall result in recommended settings for system ground fault devices. The settings shall allow coordinated settings so that the feeder devices will trip before the main device.

F. Study Report:

1. Summarize results of system study in a final report. Submit five bound copies of final report.
2. Include the following sections in the report:

    a. Description, purpose, basis and scope of study and single line diagram of that portion of power system which is included within scope of study.
    b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding same.
    c. Protective device time versus current coordination curves, tabulations or relay and circuit breaker trip settings, fuse selection and commentary regarding same.
    d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

3. Protective Device Testing, Calibration and Adjustment: Equipment manufacturer shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate and adjust the protective relays and circuit breaker trip devices as recommended in the power system study.

END OF SECTION 260500

SECTION 260519 – LOW VOLTAGE POWER WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Armored cable (type AC)

C. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 260553 – Identification for Electrical Systems

B. Section 260533 – Raceway and Boxes for Electrical Systems

1.3 REFERENCES

A. State of California Electrical Code

B. UL-4 - Armored Cable.

C. UL-83, UL-44 – Thermoplastic-Insulated Wire and Cables

D. UL-486A – Copper Connectors and Lugs

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Substitutions: Under provision of Division 01 - Substitution Procedures.

C. Product Data: Provide data for each conductor type on:

1. Insulation.
2. Conductor material and dimensions.

D. Test Reports: Indicate procedures and values obtained.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of CEC.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.6 FIELD SAMPLES

A. Provide under provisions of Division 01.

B. Submit two lengths, each 18 inches of cable assembly from each reel.

C. Select each length to include complete set of manufacturer markings.

D. Attach tag indicating cable size and application

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required

1.8 COORDINATION

A. Coordinate Work under provisions of Division 01.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

D. Coordinate the size of switchgear/switchboard/panelboard terminals to ensure they are adequately sized to accommodate specified use.

PART 2 - PRODUCTS

2.1 GENERAL

A. Marking: Insulation type, voltage rating, size and listing label shall be printed with permanent white markings repeating along entire length of conductor.

B. Provide all new wire and cable, manufactured within 12 months of delivery to site and continuously stored where protected from heat and weather.

C. Conductor packaging and reels: Plainly marked or tagged with Manufacturer's name, AWG, size, voltage rating, insulation type, agency listing and date of manufacture.

2.2 BUILDING WIRE AND CABLE

A. Manufacturers: National, Cablec, General Cable, Carol, Southwire, Rome, ITT Royal.

B. Description: Single conductor insulated wire.

C. Conductor: Copper, solid or stranded for size 10 AWG and smaller, and stranded for size 8 AWG and larger. All fire alarm wiring shall be solid conductor.

D. Insulation Voltage Rating: 600 volts.

E. Insulation: ANSI/NFPA 70, type THHN/THWN, XHHW or THW.

F. Color Coding: All power conductors identified as to phase and voltage by means of color impregnated insulation, as follows:

	Voltage	ØA	ØB	ØC	Neutral	Ground
b.	120/208V	Black	Red	Blue	White	Green
c.	277/480V	Brown	Orange	Yellow	White	Green

d. For wire sizes No. 8 AWG and larger, color banding tape, minimum 2 inches wide, may be used at all accessible locations in lieu of colored insulation.

2.3 PULL CORD

A. Empty branch circuit or system conduits: Provide mildew resistant polypropylene line, minimum 210 pound tensile strength. Greenlee Poly-Line or equal.

B. Empty feeder conduits or ducts: Provide mildew resistant polypropylene rope, minimum 1/4 inch diameter. Durlaine or equal.

2.4 ARMORED CABLE (TYPE AC)

A. Manufacturers: AFC, Alflex or equal.

B. Description: ANSI/NFPA 70, Type AC. Approved for Health Care Facility use – CEC Article 517. Manufactured in accordance to CEC Article 333. AFC Type HFC-90 or equivalent.

C. Conductor: Copper.

D. Insulation Voltage Rating: 600 volts.

E. Insulation Temperature Rating: 90 degrees C.

F. Insulation Material: Thermoplastic.

G. Armor Material: Steel

H. Armor Design: Interlocked metal tape, corrugated tube or smooth tube.

I. Number of conductors: Provide cable having a maximum of 5 conductors; 4 current carrying conductors, 1 ground conductor and 1 bare jacket bond strip.

J. Ground: Internal insulated green copper conductor; 16 AWG uninsualted aluminum jacket bonding strip.

2.5 CONTROL CABLE

A. Manufacturers: Alpha, Belden.

B. Substitutions: Under provisions of Section 012500 - Substitution Procedures.

C. Description: Multi-conductor insulated cable with color-coded PVC insulation over each conductor and an overall PVC jacket.

D. Conductor: Copper, stranded.

E. Insulation Voltage Rating: 600V.

F. Temperature Rating: -20 degrees C to +80 degrees C.

G. Agency Certification: UL recognized, passes VW-1 flame test.

2.6 WIRING CONNECTORS

A. Split Bolt Connectors:

1. Burndy, "Servit" K series,
2. Thomas & Betts "Locktite" T series,
3. or equal.

B. Solderless Pressure Connectors:

1. Burndy, "Qiklink" QR or "Qiklug" Q2 series,
2. Thomas & Betts "Locktite" 32000 series,
3. or equal.

C. Spring Wire Connectors:

1. 3M "Ranger",
2. Ideal "Wingnut",
3. or equal.

D. Compression Connectors:

1. Burndy "Hylink" YS Series,

2. Thomas & Betts "Color-Keyed" 54500 Series,
3. or equal.

E. Compression Type Terminating Lugs:

1. Copper wire and cable connections. Use long barrel type, tin plated copper/aluminum compression lugs having color-keyed tool die index marking. Provide 1-hole lugs for 8 AWG through 4/0 AWG. Provide 2-hole lugs for 250 AWG and larger. Use minimum of three crimps per lug or as recommended by the manufacturer. T & B Series 54800/54900 or equivalent.
2. Notch or single point type crimping is not permitted.

F. Crimp Type Connectors:

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel, funnel wire entry and insulation support. T & B RA Series or equal.
2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support. T & B Series R or equal.
4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support. T & B Series R or equal.

2.7 INSULATION

A. Insulating Tape:

1. Description – Black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl general purpose electrical type. Suitable for temperature for minus 18 degrees C to 105 degrees C.
2. Manufacturers - 3M "Scotch" #33, Manville "Bulldog" #166, or equal.

B. Heat-Shrink Tubing:

1. Raychem,
2. Or equal.

C. Insulating Compound (600 Volts and Below):

1. Vinyl Mastic: Self-fusing, rubber-based insulating compound, laminated to an all-weather grade vinyl (PVC) backing. 3M/Scotch 2200 Series or equal.
2. Insulation Putty: Electrical grade, rubber-based, elastic-type putty in tape form. 3M Scotchfil or equal.

D. Insulating Resin:

1. Use two part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Scotchcast 4 or equal.
2. Use with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

2.8 ACCESSORIES

A. Vertical Cable Supports:

1. O-Z/Gedney, Type "M",
2. Adalet, "SVM" series,
3. Or equal.

B. Conductor Ties:

1. Panduit, "Pan-ty",
2. Thomas & Betts, "Ty-rap",
3. Or equal.

C. Conductor Sealant (above ground):

1. Dow-Corning, #795 silicone,
2. General Electric, #SCS1000 silicone,
3. Or equal.

D. Conductor Sealant (below ground):

1. Polywater "Duct Sealant" FST,
2. Arnco "Hydra-Seal" S60STF,
3. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

B. Deliver all conductors to the site on their original cable reels or in their original unbroken packages.

3.3 APPLICATION

A. Install all conductors used for power and fire alarm in conduit or approved raceway systems.

B. Install conductors used for low voltage control systems in conduit or approved raceway systems, unless conductors used have specific listing for direct installation in ceiling plenums.

C. Install all exposed conductors and conductors concealed in walls or inaccessible ceilings and spaces in conduit or approved raceway systems. Gypsum board ceilings are considered inaccessible even where there are access panels.

D. AC cable is acceptable for concealed normal power branch circuit wiring onlyTransition to rigid conduit via pull box in accessible ceiling space prior to homerun to panel.

E. In dry interior locations, use type THHN/THWN or THW.

F. In wet or damp interior locations, use type XHHW 90 degree C insulation for feeder and branch circuit wiring.

G. In exterior locations, including underground installations, XHHW 90 degree C insulation for feeder and branch circuit wiring.

H. Make wire connections on conductors #10 AWG and smaller with spring wire connectors.

I. Make wire connections and splices on conductors #8 AWG and larger with solderless pressure connectors, compression connectors or split-bolt connectors.

J. Tape all connections made with non-insulated type connectors with insulating tape to 150 percent of the insulating value of the conductor insulation.

K. Seal around conductors with silicone sealant where conduit passes through exterior walls above grade.

L. For underground conduits, seal around conductors at nearest access point outside the building using foaming sealant.

M. Tag all conductors in junction boxes, pull boxes and wireways, indicating panelboard and circuit number.

3.4 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. conductor not smaller than #12 AWG for power and lighting circuits.

C. Use conductor not smaller than #16 AWG for control circuits.

D. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet to first outlet.

E. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet to first outlet.

F. Pull all conductors into raceway at same time.

G. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

H. Completely mandrel all underground or concrete encased conduits prior to installing conductors.

I. Completely and thoroughly swab raceway system before installing conductors.

J. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors smaller than 2 AWG.

K. Use suitable wire pulling lubricant for building wire # 4 AWG and larger

3.5 WIRE PULLING

A. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

B. Use rope made of nonmetallic material for pulling feeders.

C. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.

D. Pull in together multiple conductors or cables in a single conduit.

E. Use wire-pulling compound as lubricant for installing wires and cables in raceways. Use of oil, grease, graphite, or similar substances is not permitted.

3.6 WIRE SPLICES, JOINTS, AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, B, C, CEC and manufacturers' instructions.

B. Thoroughly clean wires before installing lugs and connectors

C. Make splices, taps and terminations to carry full ampacity of conductors, without noticeable temperature rise.

D. Make splices and termination mechanically and electrically secure.

E. Where determined that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost.

F. Terminate wires in terminal cabinets, relay and contactor panels using terminal strip connectors.

G. Bundle spare conductors using nylon ties. Leave sufficient length to terminate anywhere in the panel or cabinet.

H. Use nylon cable ties for bundling and securing wire and cable as required to maintain harnessing.

I. Encapsulate below grade splices at outlet, pull and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with specified connectors. Use same color pigtails and wire tap as the feed conductor. Form conductor prior to cutting. Provide at least 6 inches of tail and neatly packed in box after splice is made up.

K. No. 8 AWG and smaller conductor connections:

1. Use spring wire connectors
2. The integral insulator shall completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.

L. No. 6 AWG and larger conductor connections:

1. Join or tap conductors using bolted pressure connectors or compression (hi-press) taps specified. Cover using moldable insulating compound and overwrapped with two half-lapped layers of vinyl insulating tape.
2. Terminate conductors from size 6 AWG to 750 MCM copper using bolted pressure or mechanical compression lugs in accordance with manufacturer's instructions.
3. Cable sizes 250 MCM and larger: Use not less than two clamping elements or compression indents per wire for connectors.
4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature. Insulate with not less and that of the conductor level that is being joined.
5. Use hydraulic crimping tool for making compression indents.
6. Apply oxide inhibiting compound to conductors before joining, installing compression lugs or making terminations.

M. Termination Hardware Assemblies:

1. Copper lugs connected to copper bus: Secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer, and nut.
2. Install Belleville washer crown under the nut.
3. Torque bolted assemblies using the manufacturers recommendations. In the absence of such recommendations, use torque values listed in UL 486 Standards.
4. Apply silicon spray or other suitable lubricant before torquing bolts. Clean bolt surface after torquing. Mark torqued bolt heads using red or pink lacquer paint. Torque Seal or equal.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 260553 – Identification for Electrical Systems.

B. At each junction or pullbox, identify each conductor with its circuit number or other designation indicated on Drawings.

3.8 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Division 01.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

END OF SECTION 260519

SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 RELATED SECTIONS

A. Section 032100 – Reinforcing Steel.

B. Section 033000 - Cast-In-Place Concrete.

1.3 REFERENCES

A. State of California Electrical Code.

B. NFPA 99 - Health Care Facilities.

1.4 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe.

B. Metal frame of the building.

C. Concrete-encased electrode.

D. Metal underground gas piping system.

E. Rod Electrode.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

1.6 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of grounding electrodes.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish Products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:

1. Blackburn.
2. Erico.
3. Eritech.

B. Material: Copper-clad steel.

C. Diameter: 3/4-inch.

D. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:

1. Burgundy,

2. OZ/Gedney,
3. or equal.

B. Material: Bronze.

C. For use only above ground.

D. Water pipe connectors: OZ/Gedney G-200B series or equal.

E. Bonding Jumpers: OZ/Gedney BJ series or equal

2.3 COMPRESSION CONNECTORS

A. Manufacturers:

1. Thomas & Betts compression system,
2. Burndy "Hyground" compression system,
3. or equal.

B. Material: All copper.

2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:

1. Cadweld
2. Thermoweld
3. Burndyweld

2.5 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4/0 AWG.

C. Grounding Electrode conductor: Size to meet CEC requirements.

2.6 GROUNDING WELL COMPONENTS

A. Well Pipe: 12 inch diameter by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.7 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with molded plastic insulating throat (150ºC rated) and lay-in grounding lug. OZ/Gedney BLG series or equal.

2.8 MAIN BUILDING REFERENCE GROUND BUS

A. Provide one 24-inch wide by 4-inch high by 1/4-inch thick copper bus bar, or size as noted on drawings. Mount on walls in locations shown, on insulating standoffs, 18-inches above finished floor unless otherwise indicated. Furnish complete with cast cooper alloy body lugs for connecting grounding system cables. Attach lugs to bus with appropriate size bronze bolt, flat washer and Belleville washer. Torque all connections. Drill and tap holes for single hole lugs. Provide six spare lugs and lug spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

C. Provide grounding well with cover at each rod location. Install well top flush with finished grade.

D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together either by welding or exothermic connections. Bond steel located within 20-foot distance from ground conductor connection point. Perform welding in accordance with Section 032100 – Reinforcing Steel instructions.

E. Provide bonding to meet regulatory requirements. Bond panelboards serving patient areas in accordance with CEC 517-14.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Bond together reinforcing steel and metal accessories in pool and fountain structures.

H. Install ground grid under access floors. Construct grid of 2 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.

I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use 2 AWG bare copper conductor.

J. Provide grounding and bonding in patient care areas to meet requirements of NFPA 99 and ANSI/NFPA 70. Ground all outlets and equipment in accordance with CEC 517-13.

K. Provide grounding pigtails for bonding metal boxes to the ground system. Use minimum 12 AWG, insulated green conductor.

L. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

M. Install Reference Ground Bus Bars in riser electrical rooms. Bond bars to main electrical ground system using 4/0 AWG copper conductor. Route conductor in metal conduit. Bond conduit to ground system.

N. Provide PVC conduit sleeves for bare conductor pigtails penetrating concrete slabs. Use conduit size as required for conductor size.

O. Use exothermic weld kits for below grade conductor splices and foundation steel connections. Use bolted connectors for above grade terminations. Use compression connectors or exothermic weld kits for above grade splices.

P. Apply corrosion inhibitor to mechanical or compression lugs before making conductor terminations. Burndy Pentrox or equal.

3.3 EQUIPMENT

A. Ground all panels, controls, motors, disconnect switches and other equipment enclosures. Use bonding jumpers, grounding bushings, lugs, buses and other approved bonding devices for connection to the ground system.

B. Bond transformers and similar equipment to main electrical ground system by using the Reference Ground Bus Bars.

C. Bond all equipment ground buses to the main electrical ground system.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. Refer to Section 260800 – Commissioning of Electrical Systems for system testing requirements.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit supports.

B. Equipment supports.

C. Equipment anchoring and supports.

D. Fastening hardware.

1.2 RELATED WORK

A. Section 013000 – Administrative Requirements.

B. Section 033000 – Cast-in-Place Concrete: Concrete equipment pads.

C. Section 055000 – Metal Fabrications: Hangers.

D. Section 095100 – Acoustical Ceiling.

E. Section 260533 – Raceway and Boxes for Electrical Systems.

1.3 COORDINATION

A. Coordinate size, shape and location of concrete pads with Section 033000 – Cast-in-Place Concrete.

1.4 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.5 DESIGN RESPONSIBILITY

A. Design, furnish and install all required supports and bracing for electrical wiring systems and equipment.

B. Design support and anchorage systems to resist all gravity and seismic forces in accordance with the requirements of the Building Code and in accordance with procedures in Division 01.

1.6 SUBMITTALS

A. Submit dimensioned layout drawings, details, locations and structural calculations for gravity and seismic support systems. Include plans, elevations and all necessary information to satisfy the Authority Having Jurisdiction. Calculations shall be prepared and signed by a California registered Structural Engineer.

PART 2 - PRODUCTS

2.1 ANCHORS AND FASTENERS

A. Expansion, Stud and Rod Coupling Anchors: Zinc plated carbon steel. Hilti Kwik Bolt III series, Ramset Dynabolt series, or equal.

B. Adhesive Anchors: Self-Contained capsule with quartz sand, hardening agent and vinylester resin. Hilti HVA Adhesive System-HAS series or equal.

C. Sleeve Anchors: Zinc plated carbon steel. Hilti HX series or equal.

D. Drilled wedge expansion type concrete anchors, Phillips "Red-Head" WS series, Ramset "Trubolt" or equal.

E. Provide powder driven concrete fasteners with washers by Remington, Ramset, or equal.

2.2 CONDUIT STRAPS

A. Hot-dip galvanized, cast malleable iron, one hole type strap with cast clamp-backs and spacers as required.

B. OZ/Gedney "14-G" series strap and "141G" series spacer; Efcor "231" series strap and "131" series spacer; Thomas & Betts "1276" series strap and "1350" series spacer, or equal.

2.3 CONCRETE INSERTS

A. Pressed galvanized steel, spot insert, with oval slot capable of accepting support nuts of 1/4-inch to 1/2-inch diameter thread.

B. Unistrut No. M24 with "M2506" series nut; Superstrut No. 425 with "AB-102" series nut, Kinline No. 279 with "660" series nut, or equal.

2.4 DECK INSERTS

A. Steel plate 3/16-inch thick with threaded galvanized steel rod sized for load.

B. Tomarco "Blue Banger" series, Superstrut No. C-475 series, Kinline No. 293 series.

2.5 CONSTRUCTION CHANNEL

A. 1-1/2 inch by 1-1/2 inch, 12-gauge galvanized steel channel with 9/16-inch diameter bolt holes, 1-7/8 inch on center, in the base of the channel.

B. Superstrut A-1200-P, Unistrut P-1000-HS, Kinline 4112-PO, or equal.

C. Fittings, nuts and bolts: Manufactured for steel channel use, electro-galvanized finish.

2.6 THREADED ROD

A. Galvanized rod, sized for the load unless otherwise shown or specified.

2.7 CABLE TIES AND CLAMPS

A. Thomas and Betts Co. "Ty-Raps," Panduit "Pan-ty" or equal, one piece, nylon, reusable tape lashing ties.

2.8 DRYWALL MOUNTING BRACKET

A. Type MPLS by Caddy Fasteners for low voltage, Class 2 systems (TV antenna, phone jacks, sound systems) unless otherwise noted on drawings.

2.9 BEAM CLAMPS

A. Beam clamps shall attach to both flanges of a beam, provide double-flange type clamps. Single-flange clamps are unacceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide supporting devices as noted in other Sections of Division 26.

B. Install products in accordance with manufacturer's instructions.

C. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

D. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.

E. Use hollow wall fasteners in hollow masonry walls.

F. Use expansion anchors or preset inserts in solid masonry walls.

G. Use self-drilling anchors or expansion anchors on concrete surfaces.

H. Powder activated anchors may only be used if first accepted in writing by the Architect.

I. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

J. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

K. Do not drill structural steel members unless first accepted in writing by the Architect.

L. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

M. Install surface-mounted cabinets and panelboards with a minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

N. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

O. Anchor free-standing equipment on concrete pads where indicated.

3.2 LAYOUT

A. Layout support devices to maintain headroom, neat mechanical appearance and to support equipment loads.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit:

1. Rigid metal conduit and fittings.
2. Electrical metallic tubing and fittings.
3. Flexible metal conduit and fittings.
4. Liquidtight flexible metal conduit and fittings.
5. Non-metallic conduit and fittings.

B. Other Raceway:

1. Surface metal raceways.
2. Multi-outlet assemblies.
3. Wireways.

C. Boxes:

1. Wall and ceiling outlet boxes.
2. Floor boxes.
3. Pull and junction boxes.

D. Cabinets and Enclosures:

1. Hinged cover enclosures
2. Cabinets.
3. Terminal blocks.

1.2 RELATED WORK

A. Section 017329 – Cutting and Patching.

B. Section 312300 – Trenching, Backfilling and Compacting.

C. Section 031100 – Concrete Forming: Conduit sizes allowed in slabs.

D. Section 033000 – Cast-In-Place Concrete: Protective envelope for underground conduit installations.

E. Section 076000 – Flashing Sheet Metal.

F. Section 078400 – Firestopping and Smoke Seals.

G. Section 083100 – Access Panels

H. Section 262726 – Wiring Devices

1.3 REFERENCES

A. ANSI C80.1 – Rigid Steel Conduit, Zinc-Coated.

B. ANSI C80.3 – Electrical Metallic Tubing, Zinc-Coated.

C. ANSI/NEMA FB 1 – Fittings and Supports for Conduit and Cable Assemblies.

D. ANSI/NEMA OS 1 – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. ANSI/NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

F. State of California Electrical Code.

G. NECA (National Electrical Contractors' Association) Standard of Installation.

H. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

I. NEMA RN 1 – PVC Externally-Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.

J. NEMA TC 2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

K. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. NEMA WD 6 – Wiring Device Configurations.

M. NEMA ICS 4 – Terminal Blocks for Industrial Control Equipment and Systems.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. List of conduit types indicating where each type will be used.

C. List of box construction, size and finish indicating where each type will be used.

D. Raceway dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of CEC.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.8 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of floor boxes and outlets prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

A. Rigid Steel Conduit: Full weight, threaded, hot-dip galvanized, inside enameled, conforming to ANSI C80.1.

1. Manufacturers:

a. Allied
b. National
c. Triangle
d. Western

B. PVC Externally Coated Conduit: NEMA RN 1; rigid steel conduit with external 40 mil PVC coating and internal galvanized surface.

1. Manufacturers:

a. Perma-cote
b. Robroy

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

1. Rigid steel fittings:

a. Three-piece Couplings: Zinc-plated, malleable iron. OZ/Gedney "4-" series, Thomas & Betts "675" series or equal.
b. Hubs: Zinc-plated, malleable iron, with insulated throat. OZ/Gedney "CHM-T" series, Thomas & Betts "401" series or equal.
c. Insulated Bushings: Zinc-plated, malleable iron, with 150 degrees C rated, molded-on high impact phenolic thermosetting insulation. OZ/Gedney "B" series, Thomas & Betts "BIM" series, or equal.
d. Insulated Grounding Bushings: Zinc-plated, malleable iron, with 150 degrees C rated, molded-on phenolic insulation and tin plated copper saddle for grounding conductor. OZ/Gedney "BLG" series, Thomas & Betts "3870" series or equal.
e. Expansion Fittings: Up to 2 inches, OZ/Gedney "TX" series in open areas and "TX" together with "DX" series in cored openings. Above 2 inches, OZ/Gedney "AX8" series in open areas and "AX8" together with "DX" series in cored openings. All fittings complete with bonding jumper.

2. Conduit bodies: Zinc plated, malleable iron with tapered threaded hubs. OZ/Gedney "Spec 5" series, Appleton "Form 35" series or equal.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. EMT: Formed of cold rolled strip steel, electrical resistance welded, hot dip galvanized, conforming to ANSI C80.3.

1. Manufacturers:

a. Allied
b. National
c. Triangle

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; concrete tight, compression type.

1. Connectors: Zinc plated, steel body with malleable iron nut and insulated throat. OZ/Gedney "7050ST" series, Thomas & Betts "5123" series or equal.
2. Couplings: Zinc plated steel, OZ/Gedney "6050S" series, Thomas & Betts "5120" series or equal.
3. Conduit Bodies: Die cast, copper-free aluminum with set-screw hubs. OZ/Gedney "LB-50A-TW" series, Appleton "LB-50T-A" series or equal.

2.3 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Fabricated in continuous length from galvanized steel strip, spirally wound and formed to provide an interlocking design.

1. Manufacturers:

a. AFC
b. Alflex
c. National

B. Fittings: ANSI/NEMA FB 1, steel or malleable iron with insulated throat. Thomas & Betts "Tite-Bite 3110" series, OZ Gedney "KC-50T" series or equal.

2.4 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

A. Conduit: Flexible metal conduit with grey PVC jacket, integral ground conductor.

1. Manufacturers:

a. Electri-flex, type LA
b. Alflex
c. AFC

B. Fittings: ANSI/NEMA FB 1, steel or malleable iron with nylon insulated throat. Thomas & Betts "5330" series, OZ Gedney "4Q-50T" series or equal.

2.5 NON-METALLIC CONDUIT AND FITTINGS

A. Conduit: Rigid polyvinyl chloride conduit, Schedule 40, conforming to NEMA TC 2 and listed for exposed and direct burial applications. With integral belled ends on straight sections and elbows.

1. Manufacturers:

a. Carlon Plus 40
b. Pacific Western
c. PW Eagle

B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY

A. Manufacturers

1. Wiremold, Model 4000
2. Hubbell, Series 4000
3. Thomas & Betts

B. Description: Two-compartment sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. Size: Approximately 4-1/2 inches by 1-1/2 inches.

D. Finish: Ivory enamel.

E. Fittings, Boxes, and Extension rings: Furnish manufacturer's standard accessories.

F. Receptacles: Provide covers and accessories to accept receptacles as specified in Section 262726 – Wiring Devices.

G. Receptacle Spacing: As indicated on the Drawings.

2.7 TRENCH DUCT RACEWAY

A. All components of the trench header assembly shall be manufactured in accord with the standards of Underwriter Laboratories, Inc.

B. Cover plates for trench duct shall be of nominal 0.25 in. (6 mm) thick steel sheet, roller leveled after being sheared to size

C. The tile trim strip shall be of neutral gray vinyl and be designed so that either a 0.06 in. (2 mm) or 0.12 in. (3 mm) wide trim edge is available.

D. Trench duct assemblies shall be furnished in 10 ft. maximum lengths. Height adjustment shall be from:

1. 2.37–3.37 in. (61–86 mm) for a 2.50 in. (64 mm) fil
2. 3–4 in. (76–102 mm) for a 3.25 in. (83 mm) fil

E. Assemblies shall be adjustable prior to the installation of the cover plates. The tub portion of the trench shall not be more than 1.87 in. (48 mm) less than the cover plate width. Assemblies shall be non-adjustable after the pour to assure rigidity of installation.

F. The side rail assemblies shall utilize a continuous screw slot to receive the cover plates in random position anywhere along the trench duct run.

G. Provide trench partitions where required to maintain separation of services. The partition shall be adjustable to provide a cover plate support. Installer shall adjust barriers and weld barriers into permanent position with a 0.50 in. (13 mm) long weld approximately 2 ft. (610 mm) on center. Extruded plastic sound dampeners shall be provided on the top of the adjustable barriers at approximately 20 in. (508 mm) intervals. Adjustment and welding shall be done prior to the placement of covers to provide support during construction.

H. Any compartment greater than 16 in. (407 mm) wide shall have additional cover plate support.

I. The cover plates shall be a maximum of 2 ft. (610 mm) long and the abutting ends shall be gasketed. Cover plates shall be held in place by screws. The holes in the cover plate shall accept 0.12 in. (3 mm) high pan-head screws if floor tile is used or flat-head screws that shall finish flush with the cover plate if carpet is used. Cover plates shall be shipped to the job site separately from the trench duct assemblies.

J. Vertical elbows, where required, shall be an integral part of a cover plate. Tees, horizontal elbows, crosses, offsets, cover plate tape, grommets, end enclosures, risers and connectors shall be furnished to complete the installation as specified.Manufacturers

1. Square D
2. Approved Equal

~~2.7~~2.8 MULTI-OUTLET ASSEMBLY

A. Manufacturers:

1. Wiremold, Model 2400
2. Hubbell
3. Thomas & Betts

B. Multi-Outlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multi-outlet assembly.

C. Size: Approximately 1 inch by 3/4-inch.

D. Receptacles: NEMA WD 6, type 5-20R, single receptacle.

E. Receptacle Spacing: 36 inches.

F. Receptacle Color: Ivory.

G. Channel Finish: Ivory enamel.

H. Fittings: Furnish manufacturer's standard couplings, elbows, and connectors.

~~2.8~~2.9 WIREWAY

A. Manufacturers:

1. Circle A-W, 6600F series,
2. Square D, LD61 series,
3. or equal.

B. Description: General purpose type wireway.

C. Knockouts: Manufacturer's standard.

D. Size: 6 inches by 6 inches.

E. Cover: Hinged cover.

F. Connector: Slip-in.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

~~2.9~~2.10 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel. Minimum size 4 inches square, unless otherwise noted.

1. Manufacturers:

a. Steel City
b. Raco
c. Bowers

2. Luminaire and equipment supporting boxes: Rated for weight of equipment supported; include 1/2-inch male fixture studs where required.
3. Concrete ceiling boxes: Concrete type, 4 inch octagonal.

B. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Provide gasketed cover by box manufacturer. Provide threaded hubs. Manufacturers: Appleton, Crouse-Hinds or equal.

~~2.10~~2.11 FLOOR BOXES

A. Floor Boxes: ANSI/NEMA OS 1, fully adjustable before and after concrete pour, cast metal body, rectangular, complete with all necessary fittings.

B. For Pullbox or Flush Outlets:

1. Steel City 640 series.
2. Walker 880CS series.
3. Hubbell B-2436/B-4233/B-4333 series.

C. Conform to regulatory requirements for concrete-tight floor boxes.

~~2.11~~2.12 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.

1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. In-Ground Cast Metal Box for Pedestrian or Light Vehicular Traffic Areas: NEMA 250, Type 6, flanged, recessed cover box for flush mounting.

1. Material: Galvanized cast iron.
2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
3. Cover legend: ELECTRIC.
4. Manufacturers: Crouse-Hinds, Appleton or equal.

D. Precast Concrete Handholes for Vehicular Traffic:

1. Concrete handhole complete with body, cover, solid base and necessary extensions.
2. Cover shall be superimposed steel traffic type and secured with recessed hold-down bolts.
3. Size of handholes as indicated on drawings.
4. Cover legend: Electric.
5. Manufacturers:

a. Brooks Products
b. Christy
c. Forni

~~2.12~~2.13 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: See Section 260529 – Hangers & Supports.

~~2.13~~2.14 CABINET AND ENCLOSURES

A. Manufacturers:

1. Hoffman
2. Circle A50 W products
3. Square D

B. Hinged Cover Enclosures

1. Construction: NEMA 2, Type 1 or 3R steel enclosure as required for environment installed.
2. Covers: Continuous hinge, held closed by Corbin lock with cat 60 key.
3. Provide interior metal panel for mounting terminal blocks and electrical components finish with white enamel.
4. Enclosure Finish: Manufacturer's standard enamel.

C. Cabinets:

1. Box Size: As required to house components.
2. Backboard: Provide ¾-inch thick plywood backboard for mounting terminal blocks. Pain matte white.
3. Fronts: Steel flush or surface type as indicated, with concealed hinge, and flush lock keyed to match branch circuit panelboard.
4. Provide accessory feed for free-standing equipment.

D. Terminal Blocks

1. Terminal blocks: ANSI/NEMA ICS 4.
2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
4. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Size conduit per CEC for conductor type installed or for Type THW conductors, whichever is larger; 3/4-inch minimum size. If required for equipment connection provide 1/2-inch conduit to the nearest junction box.

B. See Division 27 for communications conduit requirements.

C. Arrange conduit to maintain headroom and present a neat appearance.

D. Route exposed conduit parallel and perpendicular to walls and adjacent piping.

E. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit on racks.

H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

I. Support conduit as required per California Building Code requirements.

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipecutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings, fully seat and fasten securely.

C. Use conduit hubs for fastening threaded conduit to sheet metal boxes, and for fastening conduit to enclosures in damp or wet locations.

D. Install no more than the equivalent of three, 90-degree bends between boxes.

E. Use conduit bodies to make sharp changes in direction, as around beams.

F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

J. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.

K. Where conduit penetrates fire-rated walls and floors, provide fire-stop assembly with UL listed fire rating equal to wall or floor rating.

L. Route conduit through roof openings for piping and ductwork where possible; otherwise, where conduit penetrates roof or exterior grade walls/panels, seal opening around conduit per roof or exterior wall/panel manufacturer recommendation.

M. Maximum Size Conduit in Slabs above Grade: As allowed in Divisions 03 and 05.

N. Use PVC-coated rigid steel factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length. Use PVC-coated rigid steel factory elbows for vertical bends and slab penetrations in plastic conduit runs.

O. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

P. Final connections to electric motors and other vibration isolated equipment: use flexible liquid-tight conduit or flexible metal conduit of sufficient length to provide right angle bend or 8 inch offset between motor or equipment and first rigid anchor point. Use flexible liquid-tight conduit in damp/wet locations and mechanical rooms. Use flexible metal conduit in dry interior locations.

Q. Test conduits entering building basement exterior wall for waterproof integrity according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Cap and subject conduit to static-water pressure of 15 psig, without exceeding pressure rating of conduit system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
2. Repair leaks and defects with new materials and retest conduit, or portion thereof, until satisfactory results are obtained.
3. Prepare reports for tests and required corrective action.

3.3 DUCTBANK

A. Install top of duct bank minimum 30 inches below finished grade.

B. Install conduit with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.

C. Use PVC-coated rigid steel factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length. Use PVC-coated rigid steel factory elbows for vertical bends and slab penetrations in plastic conduit runs.

D. Terminate conduit in end bell at manhole entries.

E. Stagger conduit joints in concrete encasement 6 inches minimum vertically.

F. Use suitable separators and chairs installed not greater than 4 feet on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement.

G. Encasement Concrete: Minimum 500 psi mix. Place concrete under provisions of Division 3.

1. Use red concrete for medium voltage duct encasement
2. Red color additive: Provide concrete mixture ratio containing 5-pounds of red oxide for 1-yard of concrete.

H. Provide minimum 3 inch concrete cover at bottom, top, and sides of duct bank.

I. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

J. Connect to existing concrete encasement using dowels.

K. Connect to manhole wall using dowels.

L. Provide 1/4-inch polypropylene pull rope in each empty conduit except sleeves and nipples.

M. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

N. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface

3.4 CONDUIT INSTALLATION SCHEDULE

A. Underground Installations More than Five Feet from Foundation Wall: Plastic-coated rigid steel conduit or Schedule 40 plastic conduit (in concrete for conduit over 2 inch size).

B. Installations In or Under Concrete Slab, or Underground within Five Feet of Foundation Wall: Plastic-coated rigid steel conduit or Schedule 40 plastic conduit (in concrete for conduit over 2 inch size).

C. In Concrete (where allowed): Plastic-coated rigid steel conduit.

D. Exposed Outdoor Locations: Rigid steel conduit.

E. Wet Interior Locations: Rigid steel conduit.

F. Concealed Dry Interior Locations: Rigid steel conduit or electrical metallic tubing.

G. Exposed Dry Interior Locations above 8 feet: Rigid steel conduit or electrical metallic tubing.

H. Exposed Dry Interior Locations below 8 feet: Rigid steel conduit.

3.5 RACEWAY INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wireway Supports: Provide steel channel as specified in Section 260529 – Hangers and Supports for Electrical Systems

E. Close ends of wireway and unused conduit openings.

F. Ground and bond raceway and wireway under provisions of Section 260526 – Grounding and Bonding for Electrical Systems

G. Where wireways pass through walls or barriers, cut cover within two inches of either side of wall in order to minimize length of cover which cannot be opened.

H. Identify devices under provisions of Section 260553 – Identification for Electrical Systems.

3.6 BOX INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes in accordance with NECA "Standard of Installation", to maintain headroom and to present neat mechanical appearance.

C. Set wall mounted boxes at elevations to accommodate

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 07 and Division 09.

G. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

H. Use flush mounting outlet boxes in finished areas.

I. Provide acoustical pad for flush mountedback-to-back boxes in walls; otherwise provide minimum 16 inch separation. Provide minimum 24 inches separation in acoustic rated and fire rated walls.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs. Caddy SGB series or equal.

L. Do not use outlet boxes having ears for fastening to studs. All boxes shall have minimum of two points of support from a structural element or wall stud.

M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

N. Use adjustable steel channel fasteners for hung ceiling outlet box.

O. Do not fasten boxes to ceiling support wires.

P. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

Q. Use gang box where more than one device is mounted together. Do not use sectional box.

R. Use gang box with plaster ring for single device outlets.

S. Use cast outlet box in exterior locations exposed to the weather and wet locations.

T. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

U. Set floor boxes level.

V. Large Pull Boxes: Boxes larger than 100 cubic inches in volume, or 12 inches in any dimension.

1. Interior Dry Locations: Use hinged enclosure under provisions of Section 260533 – 2.13 Electrical Cabinets and Enclosures.
2. Other Locations: Use surface-mounted cast metal box.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment furnished under other Section.

B. Coordinate locations and sizes of required access doors with Section 083100 – Access Panels.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.8 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closure in unused box openings.

3.9 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 260533

SECTION 260548 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide vibration isolation and seismic restraints in accordance with the Contract Documents.

B. Isolation for dry type transformers, and at electrical connections to rotating or vibrating equipment.

C. Seismic restraints for all electrical equipment.

1.2 QUALITY ASSURANCE

A. Vibration isolators and seismic restraints shall be of the same manufacturer.

1.3 STANDARDS

A. SMACNA Guidelines for Restraint of Mechanical Equipment.

B. Requirements for UBC Seismic Zone 4.

1.4 SUBMITTALS

A. Manufacturer's product data sheets and installation instructions for each vibration isolator and seismic restraint.

B. Plan and elevation diagrams showing equipment, points of attachment, vibration isolators, seismic restraints, mounting methods, and hardware types and sizes.

C. Seismic restraint calculations. Seismic restraint calculations shall be certified by a Professional Structural or Civil Engineer registered in the State of California.

D. Field inspection report.

1.5 FIELD INSPECTION

A. Upon completion of the installation, the manufacturer's local representative shall field inspect the installation and submit a report verifying the completeness and performance of the installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Amber-Booth, Mason Industries, Vibration Eliminator Co., Vibration Mounting & Controls Inc., or Vibrex Vibration Control Systems.

2.2 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. General:

1. Devices installed outdoors shall be weatherproof; steel components shall be hot dipped galvanized, hardware shall be cadmium plated, and springs shall be neoprene coated.
2. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
3. Springs shall have an additional minimum travel to solid equal to 50 percent of the rated deflection.

B. Mounting Method Type A:

1. Hanger rod neoprene isolators.
2. 45 degree slack seismic restraint cables.
3. Neoprene element with a projecting bushing to prevent steel to steel contact.
4. Steel retainer box encasing the neoprene element.
5. Rod shall be able to swing 15 degrees before contacting resilient bushing.
6. Mason Industries type HD neoprene hanger and type SCB seismic cable brace.

C. Mounting Method Type B:

1. Floor mounted bridge bearing neoprene mounts with all directional seismic capability.
2. Two separated and opposing molded bridge bearing neoprene elements contained in a ductile iron casting.
3. Mounting holes in bottom plate for bolting to concrete housekeeping pad.
4. Mason Industries type BR.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with seismic restraint calculations and manufacturer's installation instructions.

B. Verify that mounting methods provide the required vibration isolation and seismic restraint and that there are no vibration short circuits.

C. Conduit connected to rotating or vibrating equipment shall be flexible metal conduit or liquid tight flexible conduit.

3.2 MOUNTING SCHEDULE

Equipment	Mounting Method	Static Deflection
Dry Type Transformers-Suspended	A	0.2 inch
Dry Type Transformers-Floor Mounted	B	0.2 inch

END OF SECTION 260548

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit color coding.

D. Junction box identification

E. Panelboard directories.

F. Warning and caution signs.

G. Device coverplates.

1.2 RELATED WORK

A. Section 099110 – Exterior Painting.

B. Section 099120 – Interior Painting.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Division 01.

B. Include data sheets for identification materials furnished.

C. Include schedule for nameplates and labels.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Type NP engraved, plastic-laminated labels, signs, and instruction plates: Engraved melamine plastic laminate 1/16-inch minimum thickness for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Furnish nameplates with pre-punched mechanical fastener mounting holes.

B. Color and letter height as specified in PART 3, EXECUTION.

2.2 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key.

B. Fill engraved characters, using black paint.

2.3 WIRE AND TERMINAL MARKERS

A. Self-adhering, pre-printed, self-laminating vinyl wrap-around strips.

B. Thomas & Betts WSL, Brady B191 series, or equal.

2.4 BRASS TAGS

A. Metal tags with die-stamped legend punched for fastener. Dimensions: 2-inch diameter, 19 gauge.

2.5 INSCRIBED DEVICE COVERPLATES

A. Methods of Inscription: (Unless otherwise noted):

1. Type-on Tape:

a. Provide imprinted thermal transfer characters onto tape labeling system.
b. Tape option. Use UV stable tape rater for indoor/outdoor applications. Use black image on clear tape cartridge (Kroy industrial cartridge or equal).

B. Embossed metallic or plastic tape is not acceptable for any application.

2.6 UNDERGROUND CONDUIT MARKERS

A. During trench backfilling, for exterior underground power lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Multiple raceways installed in a common trench or concrete envelope that do not exceed an overall width of 16 inches; install a single marker.

B. 6 inch wide, 4 mil yellow polyolefin tape, with permanent continuous black imprinting reading "Buried Electric Line" or "Buried High Voltage Line".

C. Reef Industries "Terra Tape", Thomas & Betts "WBT Protect-A-Line" or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and labels.

B. Install nameplates and labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

D. Do not use tape for any application.

3.2 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

B. Provide conductor phase color coding as per Section 260519 – Low Voltage Power Wire and Cable. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markers by taping.

C. For low voltage cabling run without conduit, provide round colored vinyl tags, 1.25 inch diameter (minimum), for system cable identification. Use color-coding listed below. Install tags every 25 feet and attach using nylon ties.

1. Fire Alarm System – Red
2. Building/Management System (BMS) – White
3. Lighting Control System – Green

3.3 NAMEPLATE ENGRAVING

A. Provide type NP color coded nameplates as applicable, with the following information:

1. Equipment or device designation.
2. Amperage, KVA or horsepower rating, where applicable.
3. Voltage or signal system name.
4. "Served from" identification.
5. Miscellaneous information as shown in "Examples".
6. Examples:

a. Panelboards: 2EH1

1) 225A

2) 277/480V, 3PH, 4W
3) Served From: 2EHD1

b. Transformers: ETX-1

1) 150KVA
2) 480V – 120/208V, 3PH, 4W
3) Served From: EHD1
4) Load Served: EL1

c. Disconnects or Individual Motor Starters.

1) EF-1
2) 20HP
3) 480V,3PH,3W
4) Served From: HDERA1

B. Nameplates for power system distribution equipment and devices are to be colored as follows: (Unless otherwise noted)

1. Medium Voltage Normal – Black with white letters
2. Medium Voltage Emergency – Red with white letters
3. 277/480 VAC Normal – Yellow with black letters
4. 277/480 VAC Emergency/Battery – Red with white letters
5. 120/208 VAC Normal – Blue with white letters
6. 120/208 VAC Emergency/Battery – Red with white letters

C. Nameplates for signal systems equipment and devices are to be black except as follows:

1. Fire alarm and life safety – White with red letters
2. Building management system (BMS): White with black letters

D. Provide nameplates of minimum letter height as noted below:

1. Panelboards and Switchboards: 1/2-inch to identify equipment designation. 1/4-inch to identify voltage rating and source, etc.
2. Individual Circuit Breakers, Switches and Motor Starters in Panelboards, and Switchboards: 3/8-inch to identify load served, and 1/8-inch letters to identify all others.
3. Individual Circuit Breakers, Enclosed Switches, and Motor Starters: 3/8-inch to identify load served, 1/8-inch letters to identify all others.
4. Transformers: 1/2-inch to identify equipment designation. 1/4-inch to identify primary and secondary voltages, primary source, and secondary load and location.
5. Equipment Cabinets, Terminal Cabinets, Control Panels and other Cabinets enclosing apparatus: 3/8-inch to identify equipment and designation.

E. Provide type "LP" metal legend plates for attachment to panel mounted operator's devices such as pilot lights, push buttons, selector switches, etc.

F. Provide 2 inch high letters, red or white, porcelain enamel "Danger – High Voltage" warning sigh on all asides of the high voltage section of unit substation.

G. Provide label on all motors: "Caution – Automatic Equipment May Start at Any Time.

3.4 BRASS TAGS

A. Provide brass tags for individual ground conductors to exposed ground bus indicating connection. For example: "Ufer", "Cold water bond";

B. Provide tags for all feeder cables in underground vaults and pull boxes.

C. Provide tags for empty conduits in underground vault, pull boxes, and stubs.

3.5 CONDUIT COLOR CODING SCHEDULE

A. Coordinate color of paint with Section 099110/20 – Painting to identifying conduit by system.

B. Fire Alarm System: Red.

3.6 PANELBOARD DIRECTORIES:

A. Provide typewritten directories arranged in numerical order showing number of room in which each device served by each panelboard circuit is located.

B. Verify room numbers to be used with Owner. Room number will not necessarily be those used on the Drawings.

C. Mount directories in a 6 inch by 8 inch metal frame under a clear plastic cover inside each panelboard door.

3.7 JUNCTION BOX IDENTIFICATION

A. Paint junction, pull and connection box covers, located above suspended ceiling and below ceilings in non-public areas, using the color coding listed below.

B. Use finish paint suitable for use on metal surfaces. Provide spray paint that complies with local VOC (Volatile Organic Compound) regulations. Paint manufacturers: One-Shot, Sem or equal.

C. Legibly mark the painted covers using black permanent ink felt pen; identify circuit(s) contained in the box by circuit number(s) and panel designation.

D. Color Coding:

1. Normal 277/480 volt Systems: Fluorescent yellow.
2. Emergency 277/480 volt Systems: Fluorescent orange.
3. Normal 120/208 volt Systems: Fluorescent blue.
4. Emergency 120/208 volt Systems: Fluorescent pink
5. Fire Alarm/Life Safety Systems: Fluorescent red.

6. Building Management System (BMS): White.

3.8 WARNING, CAUTION AND INSTRUCTION SIGNS

A. Provide warning, caution, or instruction signs where required by OSHA, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect.

1. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.
2. Provide polyester film (PPS) self-adhesive signs for indoor/outdoor equipment and door warning. Use rigid polyethylene (PRS) non-adhesive signs where adhesives will not work; for example, installing on a fence. Provide sign color and marking that meets OSHA regulations. For example, DANGER (red with white letters), HIGH VOLTAGE (white with black letters).

    a. Use 2 by 4 inch signs for small equipment or enclosure doors.
    b. Use 7 by 10 inch or 10 by 14 inch signs for large equipment or enclosure doors.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

3.9 INSCRIBED DEVICE COVERPLATE

A. General:

1. Lettering Type: Helvetica, 12 point or 1/8 inch high.
2. Color of characters shall be black.
3. Locate the top of the inscription 1/2 inch below the top edge of the coverplate.
4. Install so the inscription is centered and square with coverplate.
5. Provide inscribed coverplates as noted on the Drawings or in the Specifications for receptacles, switches, outlet, plugmold, etc.
6. Provide inscribed coverplates for switches, dimmers, etc. as follows:

    a. All multi-ganged (four or more) switch plates.
    b. All special purpose switch, for example – fan, projector screen, etc. where it is not obvious what it controls.
    c. Inscription shall indicate fixtures or devices controlled (For example "Down Lights", "Cove Lights".)

7. Provide inscribed coverplates for all receptacles with panel circuit number (For example "HA1-16").
8. Label dedicated computer receptacles "COMPUTER USE ONLY".
9. Label multioutlet assembly receptacles with panel and circuit number.

B. Methods of Inscription:

1. Use imprinted thermal type-on-tape labels and install as follows:

a. Trim tape using manufactured tape trimmer.
b. Install the label so that both tape ends wrap around the coverplate side edges and are attached to the coverplate back side.

3.10 RECEPTACLES AND WALL SWITCHES

A. Write the circuit number on the front side of the device body. Locate so that cover plate conceals number. Use a fine point black permanent marking pen. Identify by noting panelboard and circuit number; for example, "HA1-16".

3.11 PROJECT CLOSEOUT

A. Provide Owner with labeling equipment and accessories as follows.

1. One Kroy Dura Type 240SE labeling machine, or equal, complete with accessories such as battery charger and case.
2. Four full tape cartridges, black image on clear tape, rated for exterior/indoor use.

END OF SECTION 260553

SECTION 262200 – LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Dry type, Secondary Voltage Transformer with extremely low no load losses.

B. Mounting supports and vibration absorbers.

1.2 REFERENCE STANDARDS

A. Underwriters Laboratories (UL).

B. American National Standards Institute (ANSI).

C. National Electrical Manufacturers Association (NEMA). #ST-20 Dry type transformers for general applications.

D. NEMA TP-1 – Energy Efficient Distribution Transformers.

E. American Standards for Transformers, Regulators and Reactors (ASTRR).

F. Institute of Electric and Electronics Engineers (IEEE).

1.3 SUBMITTALS

A. Shop Drawings: Submit in accordance with Division 01, including the following:

1. Voltage rating, KVA, phase, and cycle.
2. Insulation temperature rating.
3. Percent impedance.
4. Rated temperature rise.
5. Taps.
6. Sound level at full load, 1/2 load and no load. Transformer dimensions and weight.
7. Center of gravity dimensions
8. Paint color
9. Wiring diagram
10. Loss Data Efficiency with 25, 50, 75 and 100 percent of load."K" factor rating.

B. Seismic Mounting: submit transformer anchorage details or OSHPD pre-approved anchorage method to be used.

C. Operation and Maintenance Manuals: Submit in accordance with Division 01.

1. The operation and maintenance manuals shall include all installation and handling requirements, all initial start up test and adjustments, all maintenance requirements, troubleshooting procedures and renewal parts lists.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Division 01.

B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Manufacturer and Type: PowerSmiths or equal meeting energy performance requirements listed in specification. Transformers shall be copper wire wound; steel enclosure for all windings, connections and "K" rated where specified.

B. Taps: All transformers rated 30 KVA through 500KVA shall have two 2-1/2 percent full capacity taps above and four 2-1/2 percent full capacity taps below normal rated primary voltage. Other transformers shall have manufacturer's standard taps.

C. Connections: On primaries and secondaries provide air-filled junction boxes complete with vise type wire lugs for connection of terminating cables.

D. Core and coil assemblies shall be rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipping. Coil loss and core loss shall be optimum for efficient operation.

1. Cores shall be grain oriented, non-aging, silicon steel.
2. Coils shall be continuous windings with splices, except for taps. Coil windings shall have fasteners or tie downs for maximum strength.
3. Primary, secondary and tap connections shall be brazed or pressure type.

E. Insulation system shall have proper temperature classification as listed by UL. The insulation rating for transformers 25 KVA and smaller shall be system classification 220 degrees C, temperature rise 80 degrees C. The insulation rating for transformers 30 KVA and larger shall be system classification 220 degrees C, winding temperature rise 80 degrees C, per UL 506. Windings and the core and coil assembly shall be treated and built to resist the effects of dirt and moisture.

F. Capacity: Transformer shall be capable of operating at 100 percent of nameplate rating continuously while in an ambient temperature not exceeding 40 degrees C. Transformer shall also be capable of meeting the daily overload requirements of ANSI Standard C57.12.01.

G. Core assemblies shall be grounded to their enclosures by adequate, flexible ground straps. Enclosures shall be code gage steel. Temperature rise at hottest spot shall conform to NEMA Standards. Ventilation openings shall prevent accidental access to live components. Enclosures shall be cleaned and paint at the factory, with primer and the manufacturer's standard finish.

H. Standard NEMA features and accessories, including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.

I. Efficiency: All transformers shall meet DOE CSL3 efficiency levels and exceed NEMA TP-1 efficiency levels as minimum efficiency mandated by the State of California. Transformers shall be marked with Energy Star label.

J. Maximum No Load Losses shall not exceed:

1. 15 kVA – 60W
2. 30 kVA – 100W
3. 45 kVA – 130W
4. 75 kVA – 180W
5. 112.5 kVA – 260W
6. 150 kVA – 330W
7. 225 kVA – 450W

K. Efficiency at 1/6 loading shall meet or exceed:

1. 15 kVA – 97.0 percent
2. 30 kVA – 97.6 percent
3. 45 kVA – 97.8 percent
4. 75 kVA – 98.3 percent
5. 112.5 kVA – 98.5 percent
6. 150 kVA – 98.4 percent
7. 225 kVA – 98.6 percent

2.2 MOUNTING SUPPORTS AND VIBRATION ABSORBERS

A. In addition to integral vibration absorbers, provide vibration absorbers under the mounting channels on all floor mount transformers.

1. Double deflection neoprene mounting sized for minimum static deflection of 0.25 inch under actual load. Isolators shall be Mason Type, "BR" or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install, handle and protect transformer according to manufacturer's instructions. Install level and plumb and anchored on foundations in accordance with equipment manufacturer's instructions as indicated.

B. When moving or lifting the transformers, support the unit from the floor channels under the transformer.

C. Remove all shipping blocking and examine the transformer for shipping damage or movement of core and coil. Where damage or movement has occurred, contact the factory for correction.

D. Transformers shall be floor mounted, unless otherwise noted, with a minimum of six inch clearance to any wall for noncombustable material and twelve inch clearance to any wall for combustable material.

E. All transformers shall be connected using a 24 inch length of flexible metal conduit or flexible wireway fitting to reduce vibration transmission from the transformer to the conduit system.

F. Secondary Y neutral connection shall be grounded according to Section 260526. The transformer case shall be bonded to the ground wire.

G. Set transformer plumb and level.

H. Remove/loosen shipping bolts on internal vibration isolation supports prior to energizing.

I. Provide seismic restraints in accordance with all applicable codes and specification section 260548.

END OF SECTION 262200

SECTION 262416 – PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distribution Panelboards.

B. Lighting and Appliance Branch Circuit Panelboards.

1.2 RELATED WORK

A. Section 099110/20 – Painting: Touch-up of painted surfaces.

B. Section 262713 – Electricity Metering.

1.3 REFERENCES

A. ANSI C12 – Code for Electricity Metering.

B. ANSI C57.13 – Requirements for Instrument Transformers.

C. NEMA AB 1 – Molded Case Circuit Breakers

D. NEMA PB 1 – Panelboards.

E. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

F. NEMA PB 1.2 – Application Guide for Ground-fault Protective Devices for Equipment.

G. NECA – Standard of Installation

1.4 SUBMITTALS

A. Submit product data under provisions of Division 01.

B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; instrument details; instructions for handling and installation; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

C. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

D. Submit manufacturer's instructions under provisions of Division 01.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Division 01.

B. Store and protect products under provision of Division 01

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1.7 SPARE PARTS

A. Keys: Furnish two each to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton (Cutler Hammer)

B. General Electric

C. Schneider Electric (Square D)

D. Industrial Electric Mfg (IEM)

2.2 DISTRIBUTION PANELBOARDS

A. Distribution Panelboards: NEMA PB 1; circuit breaker type. Model # Pow-R-Line 4B. Any panelboard rated 250A or greater or having the letters "D" in its designations shall be considered a distribution panelboard.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

C. Provide door-in-door type cabinet construction. Front panel with screw cover and hinged door with flush lock. Finish in manufacturer's standard gray enamel.

D. Cabinet Locks: provide flush type cylinder locks and latches, all keyed alike.

E. Minimum fully rated Short Circuit Rating: 30,000 amperes rms symmetrical for 208 volt panelboards; 42,000 amperes rms symmetrical for 480 volt panelboards, or as shown on Drawings.

F. Circuit breakers: provide molded case circuit breakers as specified in Section 262816 – Switches and Circuit Breakers.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1 circuit breaker type. Model # Pow-R-Line 3a.

B. Enclosure: NEMA PB 1; Type 1 unless otherwise indicated on drawings.

C. Cabinet Size: 6 inches deep; 20 inches wide.

D. Provide flush or surface (as shown on Drawings) with door-in-door cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Provide metal directory holder inside door with clear plastic protector.

E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.

F. Minimum fully rated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards or as shown on Drawings.

G. Circuit breakers: provide molded case circuit breakers as specified in Section 262816 – Switches and Circuit Breakers.

H. Provide lock-on device for all breakers serving lighting, fire alarm circuits/equipment, medical equipment and sub feeds for machinery.

2.4 SWITCHING AND OVERCURRENT PROTECTIVE DEVICES

A. Provide circuit breakers in accordance with the requirements of Section 262816 – Switches & Circuit Breakers. Fully rated short circuit interrupting capacity of all devices shall be no less than the withstand rating of the switchboard.

B. Ground Fault Sensor: Zero sequence type.

C. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, 'TEST' and 'RESET' control switches.

2.5 METERING

A. Provide metering in accordance with the requirements of Section 260913 – Electricity Metering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive Work.

B. Verify field measurements are as shown on Drawings.

C. Verify required utilities are available in proper location and ready for use.

3.2 INSTALLATION

A. Install panelboards plumb, in conformance with NEMA PB 1.1 and the NECA "Standard of Installation"

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: Six feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 260553 – Identification for Electrical Systems.

G. Stub 5 empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

H. Ground and bond panelboard enclosure according to Section 260526 – Grounding and Bonding for Electrical Systems.

I. Neatly train and bundle wires using nylon ties.

J. Flush mounted panelboards located in finished areas: Paint covers to match finish color using enamel paint. Latex paint finish is not allowed. Refer to Section 099000 – Painting.

3.3 SEISMIC MOUNTING

A. Install equipment in accordance with the earthquake regulations of the California Building Code.

3.4 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

B. Test panelboards in accordance with the requirements of Section 260800 – Commissioning of Electrical Systems.

C. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

D. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper balancing for multi-wire branch circuits.

3.5 ADJUSTING AND CLEANING

A. Touch-up scratched or marred surfaces to match original finish.

B. Adjust trip and time delay setting to values recommended in short circuit and coordination study.

END OF SECTION 262416

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches

B. Wall dimmers

C. Receptacles

D. Occupancy sensors

E. Wall plates

F. Poke-through service fittings

1.2 RELATED SECTIONS

A. Section 260533 – Raceway and Boxes for Electrical Systems

B. Section 260553 – Identification for Electrical Systems

1.3 REFERENCES

A. NECA (National Electrical Contractors Association) – Standard of Installation.

B. NEMA WD 1 – General Requirements for Wiring Devices.

C. NEMA WD 6 – Wiring Device – Dimensional Requirements.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: Submit one sample of each type device and wall plate illustrating materials, construction, color and finish.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Description: NEMA WD 1, heavy-duty, AC only general-use, quiet type snap switch with fast make-slow break, silver-cadmium oxide alloy contacts, side and back wired.

B. Device Body: White plastic with matching toggle handle, except that switches serving emergency loads (critical branch, life safety branch, and equipment branch) shall be red.

C. Illuminated Handle Type Switch: Clear color handle.

D. Pilot Light: lighted handle type switch, red color handle.

E. Voltage Rating: 120-277 volts, A.C.

F. Current Rating: 20 amperes.

G. Manufacturers and Model Numbers:

1. Single-pole switch:

   a. Hubbell No. HBL-1221
   b. Pass & Seymour No. PS20AC1
   c. Leviton No. 1221-2
   d. Cooper Wiring Devices No. 2221

2. Double-pole switch:

   a. Hubbell No. HBL-1222
   b. Pass & Seymour No. PS20AC2
   c. Leviton No. 1222-2
   d. Cooper Wiring Devices 2222

3. Three-way switch:

   a. Hubbell No. HBL-1223
   b. Pass & Seymour No. PS20AC3
   c. Leviton No. 1223-2
   d. Cooper Wiring Devices 2223

4. Four-way switch:

   a. Hubbell No. HBL-1224
   b. Pass & Seymour No. PS20AC4
   c. Leviton No. 1224-2
   d. Cooper Wiring Devices 2224

5. Pilot light handle indicator switch:

a. Hubbell No. HBL-1221-PL for 120V
b. Pass & Seymour No. PS20AC1-RPL for 120V
c. Leviton No. 1221-PLR for 120V
d. Cooper Wiring Devices 2221PL for 120V

6. Illuminated handle – Locator switch:

a. Hubbell No. HBL-1221-ILC
b. Pass & Seymour No. PS20AC1-CPL7
c. Leviton No. 1221-LHC
d. Cooper Wiring Devices 2221LTV

7. Up-down control switch: 3-position, center off, momentary contact:

a. Hubbell No. HBL-1557
b. Pass & Seymour No. 1251
c. Leviton No. 1257
d. Cooper Wiring Devices 1995V

8. Digital timer switch:

a. Hubbell No. TD200
b. Pass & Seymour No. RT12W

2.2 WALL DIMMERS

A. Manufacturers:

1. Lutron "SkyLark" series.
2. Leviton "Renoir" series.
3. Pass & Seymour "Titan" series.

B. Description: NEMA WD 1; Semiconductor dimmer for incandescent or fluorescent lamps.

C. Device Body: White plastic with linear slide and on/off rocker switch

D. Voltage: 120 or 277 volts.

E. Type: Incandescent and Fluorescent matched to lamp and ballast type for compatibility.

F. Power Rating: Match load shown on Drawings, 1000 watts minimum.

G. Accessory Wall Switch: Match dimmer appearance.

1. Lutron Model NT-1PS or NT-3PS.

2.3 RECEPTACLES

A. Description: NEMA WD1, heavy duty general-use receptacle.

B. Device Body: White plastic, except that emergency receptacles (critical branch, life safety branch, or equipment branch) shall be red...

C. Configuration: NEMA WD6, type as specified and indicated.

D. Convenience Receptacle: Type 5-20R, Hospital grade.

E. Ground Fault Interrupting (GFCI) Receptacle: with LED indicating light, test and reset buttons. Shall meet UL943 including "no power to face when miswired" and "end of life indication".

F. Construction:

1. Nylon housing.
2. One-piece yoke and ground contact (except isolated ground type) made of heavy gage brass.
3. Brass contacts.
4. Solid center rivet.
5. Back and side wiring type.

G. Manufacturers and Model Number:

1. Hospital grade convenience receptacle:

   a. Hubbell No. 8300
   b. Pass & Seymour No. 8300
   c. Leviton No. 8300
   d. Cooper Wiring Devices No. 8300

2. Hospital grade GFCI receptacle:

   a. Hubbell No. GFR-8300HIL
   b. Pass & Seymour No. 2094-HG
   c. Leviton No. 8898-HG
   d. Cooper Wiring Devices No. XHGF20

3. Hospital grade tamper resistant receptacle:

   a. Hubbell No. HBL8300SGIA
   b. Pass & Seymour No. TR63-H
   c. Cooper Wiring Devices No. TR8300

4. Hospital grade isolated ground convenience receptacle:

   a. Hubbell No. IG-8300
   b. Pass & Seymour No. IG8300
   c. Leviton No. 8300-IG
   d. Cooper Wiring Devices No. IG8300RN

5. Special receptacle:

   a. Type as identified by NEMA standard number on drawings.

2.4 OCCUPANCY SENSORS

A. Description: Provide ultrasonic and dual technology type sensors. Use self-contained sensors for wall applications. Use one or two-way sensors and switchpacks for ceiling applications.

1. Wall sensor: Use white colored sensor that can be wired for single or two-level control and operate at either 120 volt or 277 volt power. Provide 30 second to 30 minute adjustable off delay feature.
2. Ceiling sensor: Use white colored sensor. Provide 30 second to 30 minute adjustable off delay feature.

B. Use ceiling mounted sensors for restrooms, corridors, and conference/meeting rooms. Use wall mounted sensors for private offices and single occupancy spaces.

C. Provide sensors and components approved/certified by the California Energy Commission, Title 24.

D. Provide sensors system suitable for NEC 725 Class 2 wiring and use plenum rated cable where approved. Contractor shall certify in wiring that installed sensors comply with CEC criteria for ultrasonic sound.

E. Wiring between sensors and controls units shall be class II, 18-24 AWG stranded UL certified, PVC insulated jacketed cable for use in plenums, where applicable.

F. All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working.

G. All sensors shall have UL rated, 94V-0 plastic enclosures.

H. Manufacturers:

1. Lutron
2. Wattstopper
3. Hubbell
4. Novitas

2.5 WALL PLATES

A. Decorative Cover Plate: Aluminum metal finish for public and patient care areas including (Public corridors, public bathrooms, waiting rooms, patient rooms and toilet rooms, and other patient care areas). White smooth nylon for all other "back of house" areas. Coordinate exact finish locations with Architect.

1. Pass & Seymour No. RP Series
2. Hubbell No. P Series
3. Leviton No. 80700 series
4. Cooper Wiring Devices No. PJ Series

B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover ("while in use rated").

1. Pass & Seymour No. CA8
2. Hubbell No. WP26MH
3. Bell No. 245-AL
4. Leviton No. 4970
5. Cooper Wiring Devices No. 989

2.6 POKE-THROUGH FITTINGS

A. Configurations:

1. Combination type: See Division 27 specifications.
2. Hard-wired power type: assembly comprising poke through component, fire stops and smoke barriers and service fitting for connection of flexible conduit up to 3/4 inch size. Hubbell No. PT7FFGY or equal.
3. Communication cabling type: See Division 27 specifications.

B. Fire Rating: 3 hours.

C. Service Fitting:

1. Type: Flush.
2. Cover Plate: black thermoplastic.

2.7 device color SChedule

A. Provide color for devices as follows, unless otherwise noted.

1. Normal power systems: White.
2. Emergency power systems: Red.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 01.

B. Coordinate wiring device heights with benches and counters to verify that coverplate will fit above backsplash.

C. Verify that outlet boxes are installed at proper height.

D. Verify that wall openings are neatly cut and will be completely covered by wall plates.

E. Verify floor boxes are adjusted properly.

F. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surfaces.

B. Clean debris from outlet boxes.

3.3 Existing work

A. Disconnect abandoned wiring devices and remove them.

B. Ensure access to existing wiring devices which remain active. Modify installation as appropriate.

C. Clean and repair existing wiring devices which remain or are to be reinstalled.

3.4 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on top or right-hand side.

G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal. Stranded conductor may be used for branch circuits 10 AWG and smaller. However, if stranded conductors are used in lieu of solid, then fork terminals shall be crimped on for all device terminations. Bare stranded conductors shall not be placed directly under the device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Install identifying nameplate on all receptacles (including receptacles in equipment furnished by others) as per Section 260553 – Identification for Electrical Systems.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 260533 – Raceway and Boxes for Electrical Systems to obtain mounting heights indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262816 – SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Circuit breakers used in unit substations, panelboards and switchgear.

B. Individually enclosed circuit breakers.

C. Fused and unfused disconnect switches.

1.2 RELATED WORK

A. Section 261116 – Secondary Unit Substations

B. Section 262400 – Switchboards

C. Section 262416 – Panelboards

1.3 REFERENCES

A. NECA "Standard of Installation".

B. NEMA 250 – Enclosures for Electrical Equipment (1000V maximum).

C. NEMA AB 1 – Molded Case Circuit Breakers.

D. NEMA SG 3 – Low Voltage Power Circuit Breakers.

E. State of California Electrical Code.

F. ANSI/UL 198C – High-Interrupting Capacity Fuses; Current Limiting Type.

G. ANSI/UL 198E – Class R Fuses.

H. NEMA KS 1/UL 98 – Enclosed Switches.

I. ANSI/ASME A17-1.

J. NFPA 72.

1.4 SUBMITTALS

A. Comply with provisions of Division 01.

B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with NECA Standard of Installation.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

1.7 SPARE PARTS

A. Furnish 3 of each size fuse to Owner.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKERS

A. Manufacturers:

1. Eaton (Cutler Hammer)
2. General Electric
3. Schneider Electric (Square D)

B. POWER CIRCUIT BREAKER

1. Air power circuit breaker meeting the requirements of NEMA SG 3.
2. Factory-assembled circuit breaker with stored energy mechanism and fully adjustable microprocessor based solid state trip unit. Breaker dual operated – either electrically or mechanically. Provide with electronic trip sensing, timing and tripping circuits for adjustable current settings, long-time pick-up and long-time delay, adjustable short time pickup and delay, and a local open and close button. Ground Fault Sensing shall be integral with circuit breaker.
3. Power circuit breakers shall be mounted in switchboards in a draw-out configuration.
4. Terminals shall be rated for 75 degrees Centigrade minimum.
5. Fully rated short circuit interrupting capacity shall be minimum 65,000A, but no less than the withstand rating of the equipment that it is installed in, unless otherwise noted.
6. 30 cycle withstand rating shall be 65,000A, but no less than the withstand rating of the equipment that it is installed in, unless otherwise noted.

C. INSULATED CASE CIRCUIT BREAKER

1. NEMA AB 1 molded case circuit breaker, commonly classified by manufacturers as "insulated case" type.
2. Factory-assembled circuit breaker with two-step stored energy mechanism and fully adjustable microprocessor based solid state trip unit. Breaker dual operated – either electrically or mechanically. Provide with electronic trip sensing, timing and tripping circuits for adjustable current settings, long-time pick-up and long-time delay, instantaneous trip, adjustable short time pickup and delay, and a local open and close button. Ground Fault Sensing shall be integral with circuit breaker.
3. Insulated case breakers shall be fixed mounted type for feeder breakers in unit substations and draw out type in all other applications.
4. Terminals shall be rated for 75 degrees C minimum.
5. Fully rated short circuit interrupting capacity shall be minimum 65,000A, but no less than the withstand rating of the equipment that it is installed in, unless otherwise noted.

D. MOLDED CASE CIRCUIT BREAKER

1. Circuit Breaker: NEMA AB 1, bolt-on type circuit breaker with trip sensor in each pole.
2. Circuit breakers with trip ratings over 100A shall have frame size minimum 225A.
3. Circuit breakers 400A and greater frame size shall have solid state trip units. Include ground fault trip where indicated.
4. For short circuit ratings, see specification section of equipment in which circuit breaker is installed.
5. Terminals shall be rated for 75 degree C minimum.

E. TRIP UNITS

1. Field-Adjustable Trip Circuit Breaker: Provide circuit breakers with frame sizes 800 amperes and larger with mechanism for adjusting long time continuous current setting for automatic operation.
2. Field-Changeable Ampere Rating Circuit Breaker: Provide circuit breakers with frame size 400 amperes and larger with changeable trip units.
3. Insulated case circuit breakers shall have metering capability with a display for voltage, current, power and energy readings.

F. PRODUCT OPTIONS AND FEATURES

1. Provide accessories as indicated, to NEMA AB 1.
2. Shunt Trip Device: 120 volts.
3. Handle Lock: Include provisions for padlocking.
4. Provide mechanical trip device.
5. Provide Products suitable for use as service entrance equipment where so applied.

G. ENCLOSURE

1. NEMA AB1, Type or as suitable for use where located.
2. Fabricate enclosure from steel.
3. Finish using manufacturer's standard enamel finish, gray color.

2.2 DISCONNECT SWITCHES

A. Manufacturers:

1. Eaton (Cutler-Hammer)
2. General Electric.
3. Schneider Electric (Square D)

B. Fusible Switch Assemblies: NEMA KS 1; Type HD; quick make, quick break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class J fuses.

C. Nonfusible Switch Assemblies: NEMA KS 1; Type HD; quick make, quick break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

D. Enclosures: NEMA KS 1; Type 1 unless otherwise indicated on Drawings.

2.3 MANUFACTURERS – FUSES

A. Bussman

B. Ferraz-Shawmut

2.4 FUSES

A. Fuses 600 Amperes and Less: ANSI/UL 198C, Class J sized as indicated on Drawings; dual element one-time fuse, 600 volt.

B. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers and disconnect switches where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 260529 – Hangers and Supports for Electrical Systems.

C. Install fuses in fusible disconnect switches.

D. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

E. Provide engraved plastic nameplates under the provisions of Section 260553 – Identification for Electrical Systems.

3.2 TESTING

A. Field inspection and testing will be performed under provisions of Section 260800 – Commissioning of Electrical Systems.

B. Inspect and test each circuit breaker to NEMA AB 1or SG 5, as applicable.

C. Inspect each circuit breaker visually.

D. Perform several mechanical ON-OFF operations on each circuit breaker.

3.3 COMMISSIONING

A. Refer to Section 260800 – Commissioning of Electrical Systems for system commissioning requirements.

END OF SECTION 262816

SECTION 262913 – ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Manual starters

B. Magnetic motor starters

C. Combination magnetic starters

1.2 RELATED SECTIONS:

A. Section 262816 – Switches and Circuit Breakers.

1.3 REFERENCES

A. NEMA AB 1 – Molded Case Circuit Breakers and Molded Case Switches.

B. NEMA FU 1 – Low Voltage Cartridge Fuses.

C. NEMA ICS 2 – Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

D. NEMA ICS 5 – Industrial Control and Systems: Control Circuit and Pilot Devices.

E. NEMA ICS 6 – Industrial Control and Systems: Enclosures.

F. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

G. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

A. Submit in accordance with Division 01.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices. Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

D. Submit manufacturer's instructions under provisions of Division 01.

E. Test Reports: Indicate field test and inspection procedures and test results.

1.5 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 01.

B. Project Record Documents: Record actual locations and ratings of enclosed controllers.

C. Submit Operation and Maintenance Data in accordance with Division 01.

D. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 5 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Deliver in 60 inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

C. Store and protect products under provisions of Division 01.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS – MOTOR STARTERS

A. Eaton (Cutler-Hammer)

B. General Electric

C. Schneider Electric (Square D)

2.2 manual motor starters

A. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, single pole, full voltage controller for fractional horsepower induction motors, with thermal overload unit, green pilot light, NO auxiliary contact and toggle operator.

B. Motor Starting switch: NEMA ICS 2; AC general-purpose Class A manually operated single pole, full voltage controller for fractional horsepower induction motors, without thermal overload unit, red pilot light, NO auxiliary contact, and toggle operator.

C. Enclosure: ANSI/NEMA ICS 6; Type 1, unless otherwise noted on Drawings.

2.3 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Full Voltage Starting: Non-reversing type.

C. Reduced Voltage Starting: Open-circuit transition wye-delta type.

D. Two Speed Starting: Two speed, two winding, variable torque type. Include integral time delay transition between FAST and SLOW speeds.

E. Coil Operating Voltage: 120 volts, 60 Hertz.

F. Size: NEMA ICS 2; size as shown on Drawings.

G. Overload Relay: NEMA ICS 2; electronic type with sensing elements in all three phases.

H. Enclosure: NEMA ICS 6; Type 1, unless otherwise indicated on the Drawings.

I. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.

J. Auxiliary Contacts: NEMA ICS 2; two normally open and two normally closed contacts in addition to seal-in contact.

K. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO in front cover.

L. Indicating Lights: NEMA ICS 2; RUN: green in front cover.

M. Control Power Transformers: 120 volt secondary, 50 VA minimum, in each motor starter. Provide fuses on primary and secondary of transformer and bond unused leg of secondary to enclosure.

N. Provide terminal strips for external control including Fire Department Control Panel, smoke detector, fire alarm, temperature control wiring and interlock wiring as required.

2.4 CONTROLLER OVERCURRENT PROTECTION

A. Motor Circuit Protector: NEMA AB 1, circuit breakers with integral instantaneous magnetic trip in each pole.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive Work.

B. Verify field measurements are as shown on Drawings.

3.2 SEISMIC MOUNTING

A. Provide anchorage details, coordinated with the motor control equipment mounting provisions, prepared and stamped by a licensed civil engineer.

3.3 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 262913

SECTION 265100 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories.

B. Low level and ceiling mounted exit signs.

C. Ballasts.

D. Lamps.

E. Luminaire accessories.

1.2 RELATED SECTIONS

A. Section 233600 – Air Terminal Units: Air distribution accessories for air handling luminaires.

B. Section 260533 – Raceway and Boxes for Electrical Systems.

C. Section 260933 – Central Dimming Lighting Controls

1.3 REFERENCES

A. ANSI C78.379 – Electric Lamps – Incandescent and High-Intensity Discharge Reflector Lamps – Classification of Beam Patterns.

B. ANSI C82.1 – Ballasts for Fluorescent Lamps – Specifications.

C. ANSI C82.4 – Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. ANSI C82.11 – Ballast limits for Total Harmonic Distortion and Standardized Color Coding.

E. State of California Electrical Code.

F. ANSI/NFPA 101 – Life Safety Code.

G. NEMA WD 6 – Wiring Devices-Dimensional Requirements.

H. UL 935 – Standard for Fluorescent Ballasts.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements".

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of each luminaire.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Maintenance Data: Include replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of ANSI/NFPA 101.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as specified in schedule on Drawings.

B. Substitutions: Under provisions of Division 01.

C. Install ballasts, lamps, and specified accessories at factory.

2.2 BALLASTS

A. General requirements.

1. Provide ballast suitable for lamps specified.
2. Number of ballasts per fixture shall be provided to meet control intent shown on plan drawings. Manufacturer's catalog numbers do not designate quantity of ballasts required to meet control intent.
3. Voltage: 120/277 volts. Match luminaire voltage.
4. Ballast must operate between 108V-132V for 120V operation or between 249-305V for 277V operation.
5. Ballast shall be greater than or equal to 0.85.
6. Ballast shall have an "A" sound rating or the quietest rating for a particular ballast class.
7. Ballasts shall maintain light regulation of +/-10 percent with +/-10 percent input voltage variation.
8. Ballast shall have a 3 year manufacturer's warranty, including a $10 per ballast labor allowance.
9. Lamp current crest factor shall not exceed 1.7.
10. Ballast shall meet ANSI C82.11 limits for Total Harmonic Distortion (THD).
11. All ballasts shall have a maximum lead length from ballast to lamp socket less than or equal to the manufacturer's recommendation.
12. Ballast shall provide transient immunity as specified in ANSI C62.41.
13. Ballast shall be provided with integral leads, color coded to ANSI standard C82.11.
14. All fluorescent T8, T5, T5HO & electronic HID ballasts must contain a lamp end-of-life protection and shut down in accordance with ANSI/IEC proposed standards.

B. Fluorescent ballasts.

1. General requirements.

a. Description: ANSI C82.1, high power factor, electronic ballast, Class P thermally protected, unless otherwise specified.
b. Ballast factor shall have a power factor of not less than 0.95.
c. Ballasts shall have a total harmonic current distortion (THD) of less than 10 percent at maximum light output.

d. Ballast output frequency shall be greater than 40 kHz to avoid interference with infrared control systems, and eliminate visible flicker.
e. Ballast must be able to start and operate the specified lamps at a minimum temperature of 0 degrees Fahrenheit as indicated on the datasheet and shall be in accordance with lamp manufacturer's recommendations.

2. General dimming ballast requirements.

a. Where dimming controls are used, dimmable ballasts and lighting control systems shall be compatible.
b. Dimming shall control lamp light output ranging from 10 percent-100 percent.
c. Dimming ballasts shall be capable of striking lamps at any light level without first flashing to full light.
d. Ballasts shall have a power factor greater than 0.90 for the entire dimming range.
e. Electronic ballast shall not be damaged by mis-wiring line voltage and control wire leads or any output lead to another output lead.
f. THD at minimum light output shall not exceed 10 THD at maximum light output.
g. 0 to 10V Dimming ballasts shall be controlled by Class 1 low-voltage wiring.
h. 0 to 10V Dimming ballasts shall be controlled by compatible low voltage lighting controls.

3. Ballasts for Compact Fluorescent Lamps (CFL) with fixed light output:

a. Osram Sylvania, Quicktronic CF
b. Advance, VH-1B or VH-1Q Series,
c. Ballast shall have been on the commercial market for a minimum of 2 years.

4. Ballasts for T8 Fluorescent Lamps with fixed light output:

a. Osram Sylvania, Quicktronic PSN
b. Advance, VIC (or RIC) S32
c. Ballast shall be program start, programmed rapid start or rapid start.
d. Ballast shall be program start when controlled by occupancy sensors.
e. Ballast shall have been on the commercial market for a minimum of 2 years.

5. Ballasts for T5 Fluorescent Lamps with fixed light output:

a. Osram Sylvania, Quicktronic PS
b. Advance, VCN (or RCN) S28
c. Energy Savings, ES-T5-28-UNV
d. Ballasts shall be program start.
e. Ballast shall have been on the commercial market for a minimum of 1 year.

6. Ballasts for Fluorescent T5HO Lamps with fixed light output:

a. Osram Sylvania, Quicktronic PHO.
b. Advance, ICN

c. Energy Savings, ES-T5-54-UNV
d. Ballasts shall be program start.
e. Ballast shall have been on the commercial market for a minimum of 1 year.

7. Ballasts for low voltage fluorescent dimming:

a. Lutron [10 percent-100 percent]
b. Osram Sylvania [10 percent-100 percent]
c. Advance [10 percent-100 percent]
d. Universal [10 percent-100 percent]
e. Ballast shall be programmed rapid start.
f. Ballast shall have been on the commercial market for a minimum of 2 years.

8. Ballasts for line-voltage fluorescent dimming:

a. Lutron, [10 percent-100 percent]
b. Advance [10 percent-100 percent]
c. Advance [10 percent-100 percent]
d. Universal [10 percent-100 percent]
e. Ballast shall be program start.
f. Ballast shall have been on the commercial market for a minimum of 2 years.

C. High Intensity Discharge Ballasts

1. General requirements.

a. Ballasts shall be designed in accordance with ANSI C82.4 and applicable ANSI specifications.
b. High intensity discharge lamp ballasts shall be high power factor, constant wattage autotransformer (CWA) or regulating type, conforming to applicable NEMA standards.
c. Minimum starting temperature: Minus 20 degrees F.
d. The core & coil ballast shall be designed with class "H" (180 degrees C) or higher insulation system.
e. Interior ballasts shall be encapsulated type with the lowest sound rating available unless specified otherwise.
f. All HID ballast shall contain no exposed live parts.
g. Ballast must be able to start and operate the specified lamps at a minimum temperature of 0 degrees Fahrenheit as indicated on the datasheet and shall be in accordance with lamp manufacturer's recommendations.
h. All ballasts shall be provided with multiple input voltage taps on the primary coil when available.

2. Igniters for High Intensity Discharge Ballasts.

a. Remote ballasts shall have properly sized igniter as required for pulse start lamp specified.

2.3 LAMPS

A. Incandescent & Halogen Lamp Manufacturers:

1. General Electric
2. Osram Sylvania
3. Philips
4. MR-16 lamps shall use IR technology equal to Osram Sylvania or Philips unless otherwise specified.

B. Fluorescent Lamp Manufacturers:

1. General Electric
2. Osram Sylvania
3. Philips

C. High Intensity Discharge (HID) Lamp Manufacturers:

1. Venture
2. General Electric
3. Osram Sylvania
4. Philips

D. Provide lamp type specified for luminaire.

E. Reflector Lamp Beam Patterns: ANSI C78.379.

2.4 LOW VOLTAGE TRANSFORMERS & power SUPPLIES

A. Remote low voltage transformers:

1. Low voltage transformers shall be core and coil construction, unless otherwise noted.
2. Where transformers are integral to the fixture, they shall be accessible from below.
3. Sound rating shall be the lowest available. Replace excessively noisy transformers at no cost to the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install suspended exit signs using stem pendants from swivel hangers.

C. Install suspended luminaries using stem pendants from swivel hangers, aircraft cable, and chain in accordance with the intended design. Provide stem pendants, aircraft cable, and chain lengths required to suspend luminaire at indicated height.

1. In addition to gravity supports, design and provide bracing in accordance with the requirements of the Building Code

D. Support luminaire larger than 2 x 4 foot size, or heavier than 56 pounds independent of ceiling framing.

E. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

F. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

G. Exposed Grid Ceilings: Support surface mounted luminaires on gird ceiling directly from building structure.

H. Install recessed luminaires to permit removal from below.

I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Install clips to secure recessed grid-supported luminaires in place.

K. Install wall mounted luminaires and exit signs at height as indicated on Drawings.

L. Install accessories furnished with each luminaire.

M. Connect luminaires and exit signs to branch circuit outlets provided under Section 260533 – Raceway and Boxes for Electrical Systems using flexible conduit as required.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

O. Bond products and metal accessories to branch circuit equipment grounding conductor.

P. Install specified lamps in each luminaire.

Q. In indoor locations, each luminaire utilizing double-ended fluorescent lamp(s) shall be provided with disconnecting means concealed from view in accessible location, above ceiling or within fixture. Disconnecting means shall be capable of simultaneously disconnecting from supply all conductors to ballast(s), including the grounded conductor(s) if any. The line side terminals of the disconnecting means shall be guarded. All disconnects shall be a maximum of 3 horizontal feet from fixture ballast.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Interface with air handling accessories furnished and installed under Section 233600 – Air Terminal Units.

3.4 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connections and operation.

3.5 ADJUSTING

A. Adjust Work under provisions of Division 01.

B. Provide materials and labor for aiming and adjusting lighting fixtures under Lighting Designers supervision after dark where required. Aiming and adjusting shall take place immediately before building is turned over to Owner. Refer to fixture schedule for aiming requirements.

C. Adjust exit sign directional arrows as indicated.

D. Relamp luminaires that have failed lamps at Substantial Completion.

E. Provide all new lamps burned in at full brightness for 100 hrs.

3.6 CLEANING

A. Clean Work under provisions of Division 01.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.7 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 01.

B. Provide minimum of two hours demonstration of luminaire operation.

END OF SECTION 265100

SECTION 270510 - COMMON WORK RESULTS FOR STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Related Requirements: Comply with the following:

1. Section 012500 – Substitution Procedures.
2. Section 013300 – Submittal Procedures.
3. Section 014000 – Quality Requirements.
4. Section 014200 – References.
5. Section 016000 – Product Requirements.
6. Section 017329 – Cutting and Patching.
7. Section 017419 – Construction Management and Disposal
8. Section 017800 – Closeout Submittals.
9. Section 078400 – Firestopping.

C. This section covers common work results that shall be applied to each of the following “subsections” only:

1. Section 270526 – Grounding and bonding for structured cabling system.
2. Section 270536 – Cable trays for structured cabling system.
3. Section 270553 – Identification for structured cabling system.
4. Section 271116 – Structured cabling system cabinets, racks, frames, and enclosures.
5. Section 271300 – Structured cabling system backbone cabling.
6. Section 271500 – Structured cabling system horizontal cabling.

1.2 PROJECT INFORMATION

A. Project Identification: Natividad Medical Center Radiology Modernization,

B. Project Number: 1412600.

C. Project Location: 1441 Constitution Blvd., Salinas, California.

D. Owner: Count of Monterey.

E. Owner's Representative: Brian Griffin, Interim Director of Engineering.

F. Architect: RBB Architects Inc., 10980 Wilshire Boulevard, Los Angeles, California 90024-3905.

1.3 SUMMARY

A. Section Includes:

1. Glossary.
2. Definitions.
3. Regulations, codes, and standards compliance.
4. Quality assurance.
5. Submittals.
6. Substitutions, deviations, and changes.
7. Common Product Requirements.
8. Common Execution Requirements.

1.4 GLOSSARY

A. The following abbreviations and definitions may be found in this section and related subsections:

1. ADA – Americans with Disabilities Act
2. ANSI – American National Standards Institute
3. ASTM – American Society of Testing and Materials
4. BICSI – Building Industry Consulting Services International
5. EIA – Electronic Industries Association
6. EMI – Electromagnetic Interference.
7. FCC – Federal Communications Commission
8. ICEA – Insulated Cable Engineers Association
9. IDC – Insulation Displacement Connector
10. IEEE – Institute of Electrical and Electronics Engineers
11. ISO– International Organization for Standardization
12. ITSIM – Information Transport Systems Installation Manual
13. LAN – Local Area Network
14. NEC – National Electric Code
15. NEIS – National Electrical Installation Standards
16. NEMA – National Electrical Manufacturer’s Association
17. NESC – National Electrical Safety Code
18. NRTL – Nationally Recognized Testing Laboratories
19. NFPA – National Fire Protection Association
20. OSHA – Occupational Safety and Health Administration
21. RCDD – Registered Communications Distribution Designer.
22. TDMM – Telecommunications Distribution Methods Manual
23. TIA – Telecommunications Industry Association
24. UFBC – Uniform Fire Prevention and Building Code
25. UL – Underwriters Laboratories, Inc.
26. UTP – Unshielded Twisted Pair

1.5 DEFINITIONS

A. Every effort has been made to use industry standard terminology throughout this section and related subsections, but industry standard terminology is not used by all manufacturers and in many cases, industry standard terminology does not exist. Contractor shall notify the Architect and/or Engineer requesting definition of any terminology used in this section or related subsections and.

B. The following terms and definitions may be found in this section and related subsections:

1. “Authority Having Jurisdiction (AHJ)”: Federal, state, local, or other regional department, or individual having statutory authority.
2. “Architect”: Architect of record.
3. “As directed”: as directed by the Architect or the Engineer.
4. “Connect”: Shall mean make final electrical/optical connections for a complete operating piece of equipment.
5. “Contractor”: the individual, partnership or corporation to whom the Contract for the Telecommunications work has been awarded.
6. “Engineer”: Engineer of record.
7. “Equal”: Shall be of the same quality, appearance and utility to that specified, as determined by the Owner’s Representative. Contractor bears the burden of proof of equality.
8. “Final Acceptance”: Owner’s Representative’s acceptance of project from Contractor.
9. “Finished spaces”: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
10. “Furnish”: to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application.
11. “Install”: to join; unite; fasten; link; attach; set up or otherwise connect together; complete, tested, and ready for normal satisfactory operation.
12. “Provide”: Shall mean furnish and install complete with all details and ready for use.
13. “Relocate”: Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready to use.
14. “Replace”: Remove and provide new item.
15. “Rough-in”: Pipe, duct, conduit, equipment layout and installation.
16. “Submit”: submit to the Architect and/or the Engineer for review.

1.6 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. References and regulations, codes and standards mean the latest edition, amendment and revisions to the regulations, codes and standards in effect on the date of the Contract Documents.

B. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing codes and regulations of federal, state, and local government agencies.

C. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the Shop Drawings.

D. Local electrical and building codes may be differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity refer to the Owner/Engineer for interpretation.

E. Installations, materials, equipment and workmanship shall conform to the specifications and drawings and all applicable provisions of the following regulations, codes and standards including all applicable addendum:

1. FCC documents
2. ANSI standards
3. TIA Standards
4. BICSI Standards
5. ADA
6. IEEE standards
7. NESC
8. ICEA standards
9. NEIS standards
10. NFPA codes and standards
11. ASTM Standards
12. NEMA Standards
13. OSHA Standards
14. All other authorities having jurisdiction.

1.7 QUALITY ASSURANCE

A. All products shall be installed new, clean, best of their respective kinds, free from defects, listed by Underwriter's Laboratories for the intended use, and bearing their label.

B. Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item will not be permitted, unless specifically noted otherwise.

C. Obtain from the manufacturers detailed instructions for installation of that manufacturers' products.

D. Ensure that all components meet all regulatory requirements for the respective component being used.

E. All products, services and materials provided and performed under the scope of this specification and covered subsections shall conform to the manufacturer's requirements.

F. Qualification data:

1. In order to provide proper coordination, uniform quality and system integrity, the equipment and installation specified within this specification and applicable subsections shall be provided and installed by a single contractor with a proven track record in the field of the specified system. Personnel shall be competent and qualified by experience and training for the installation.
2. Contractor shall be trained and certified by the manufacturer of the proposed system as a Certified Installer. A copy of the certificate shall be included with the bid.
3. Upon award of the project and prior to the commencement of work, provide evidence that the General Foreman, Foreman or Crew Leader of the installation crew holds the designation of BICSI Technician, and that thirty-three percent (33%) of the installers have completed the BICSI Installer Level 1 or greater. The certificates of at least one BICSI Technician and one BICSI Installer Level 1 or 2 shall be submitted with the proposal documents.

1.8 SUBMITTALS

A. General Procedures

1. All submittals shall comply with the requirements of Division 1 – General Requirements.
2. Forward all submittals and resubmittals in minimally complete groups as listed below. Partial submittals are not acceptable.

B. List of Submittals

1. Action submittals:

a. Product data.
b. Shop drawings.
c. Delegated design: For seismic restraints.
d. Samples.
e. Product schedules.
f. Product test reports.
g. Qualification data.
h. Project Plan & Schedule

2. Informational submittals:

a. Coordination drawings.
b. Field test reports.
c. Qualification certificates.
d. Contractor warranty.
e. Manufacturers’ warranties.
f. Maintenance data.
g. Record drawings.

1.9 Action submittals

A. Product data:

1. Product data sheets shall include construction details, material descriptions, dimensions of individual components and profiles and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Product data sheets shall depict the components to be installed to make up the complete system as described in the specifications.
3. The product data sheet submittal shall comply with the following:

    a. Submit pertinent pages only.
    b. Identify clearly the particular product being submitted; do not use highlighters.
    c. Identify any options or accessories that are applicable to the project.
    d. Show compliance with any parameters required by the specifications.
    e. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
    f. Show any special coordination requirements for the product.

B. Shop drawings:

1. Shop drawing submittal shall include the following:

    a. Drawing scale
    b. Diagrams showing evidence of compliance with contract documents and coordination with other trades.
    c. Associated diagrams of all equipment, with types and model numbers, labeling, etc. as specified under these contract documents.
    d. Drawings (to scale) showing elevations, equipment and wall elevations, mounting locations and dimensions and labeling of equipment.
    e. Specific notation of field measurements at accurate scale.

C. Delegated design: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

D. Samples:

1. Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed as required by covered subsections complying with the following:

    a. Provide samples physically identical with proposed material or product.
    b. Where selection is required, provide full set of all options.
    c. Where non-specified products are proposed, provide full set of all options.

E. Product schedules:

1. The product schedules shall include, but are not limited to:

    a. Sequential line number
    b. Outlet labeling
    c. Cable labeling
    d. Strand labeling
    e. Cable length
    f. Jack labeling
    g. Patch panel/termination frame label
    h. Position/port numbers
    i. Cabinet/rack labeling
    j. Pathway labeling

F. Product test reports:

1. Submit product test reports as required by subsection indicating that current product produced by manufacturer complies with requirements in the Contract Documents.
2. Reports shall be based on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
3. Product test report submittal shall consist of the following:

    a. Table of Contents shall include product type and number.
    b. Submit product test results as specified, sorted by unique label identifiers.
    c. Each test must show the full label, test types, test parameters, date and time tested and the test result.

G. Qualification data:

1. Prepare written information that demonstrates capabilities and experience of firm or person as specified herein.

    a. All qualifications listed in 1.7 QUALITY ASSURANCE
    b. Lists of completed projects with project names and addresses, contact information of architects and owners.

H. Project Plan & Schedule:

1. Prepare a project plan and schedule based on the scope of work defined herein and general project schedule reflected in Division 1 including the following.

    a. Project milestones (include other milestones as required)

        1) Submittal packages.
        2) Product procurement, indicate equipment with long lead times.
        3) Rough in coordination.
        4) Fabrication.
        5) Rough in complete.
        6) Installation.
        7) Equipment room turnover (clean).
        8) Substantial completion.

9) Testing.

b. Labor allocation (minimum 1 week increments) including installation crew detail (General Foreman, Foreman, Crew Leader, Team member, etc.)

1.10 Information Submittals

A. Coordination drawings:

1. Prepare coordination drawings according to requirements in individual Sections.

B. Field test reports:

1. Provide field test reports for all field-terminated cables
2. Field test report submittal shall show test results sorted by cable label.
3. In addition to individual test reports, provide a summary format showing one line item per cable tested for all cables including the full cable label, test type, cable length, date and time tested and the test result.

C. Qualification Certificates:

1. Project specific certificate of system compliance with qualification criteria
2. Seismic Qualification Certificates:

a. Seismic performance for products, accessories, and components from manufacturer.
b. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
c. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
d. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Contractor warranties:

1. Statement of overall warranties provided by contractor to complement manufacturers' warranties
2. All work and all items of equipment and materials shall be warranted for a minimum period of one year from the date of acceptance of the work. Where a manufacturer's warranty is longer than one year, the Contractor shall offer the extended warranty. The Contractor shall, upon notification of any defective items, repair or replace such items within 24 hours without cost to County, all to the satisfaction of the Architect.
3. The installed passive components of the Work described in the Contract Documents shall be covered under a manufacturer supported Lifetime Warranty related to installed materials, supported applications and the installation workmanship. This guarantee and extended warranty shall be supported in writing by both the connectivity and cable manufacturer and shall address and cover the following:

a. All defects in wire, cable, components and/or other materials in the Voice and Data Communication System.

b. All specification and performance parameters of system components as presented in the Construction Documents at the time of installation completion will be warranted/ guaranteed to provide margins of 3.0 dB for all frequencies swept from 1 – 250 MHz for the published TIA/EIA 568C parameters for NEXT, PSNEXT, ELFEXT, PSELFEXT, and Return Loss performance standards as published in TIA/EIA for more than one manufacturer.
c. All installed components of the data backbone system shall support ten (10) Gigabits per second Ethernet applications that use 850 nm transceivers for serial transmission in LOMMF (OM3) at distances up to three hundred (300) meters.
d. All workmanship associated with any warranty issues related to providing, installing, certifying and documenting the Work described in the Construction Documents shall be covered by this warranty.

4. Contractor shall respond to the owners request and correct any problems, malfunctions, and warranty issues associated with the Work described in the Construction Documents without additional charge to the owner within three (3) calendar days for the entire warranty period, as stated in the Warranty.
5. The owner considers the Voice Data Communications System components a whole, complete system and requires an integrated component/cable warranty from both the cable manufacturer and the connectivity manufacturer for material and installation workmanship as described in the construction documents.

a. Acceptance of Project

1) The Owner's IT Representative shall accept the project as complete based on the following criteria:

a) Before executing any performance testing, the Contractor shall present a test plan in writing to the owner's IT representative for his or her written approval.
b) The Contractor has completed all testing and delivered written copies of all test results to the owner's IT representative and Electrical Engineer.
c) All test results have been examined and approved in writing by the owner's IT representative and the Electrical Engineer.
d) Copies of all documentation required by this section have been delivered to the owner's IT representative.
e) All punch list items are completed to the written satisfaction of the owner's IT representative and the Electrical Engineer.
f) Certification that the Contractor has submitted all final test results and certification information to product manufacturer for copper and fiber warranty.

E. Manufacturers' warranties:

1. All warranties as required by related subsections shall be provided by the representative manufacturer(s) and shall be extended to the Owner and certified in writing.

F. Maintenance data:

1. Provide a summary and calendar of maintenance requirements and recommendations for all components of the project.

G. Record drawings:

1. Each submittal shall consist of the following:

a. Installation schedule, including all cross-connection and patching schedule
b. Floor plans indicating outlet locations and labels.
c. The drawings shall include, but are not limited to block diagrams, all cable labeling, cable termination points, equipment room layouts and frame installation details.
d. The drawings shall include all field changes made up to construction completion.

1.11 SUBSTITUTIONS, DEVIATIONS, AND CHANGES.

A. Substitutions

1. Requests for substitutions are only permitted for materials specified with an “or approved equal” clause or other language of same effect in the Contract Documents. Substitutions for the main system components shall be equivalent products from one of the manufacturers included in the list of approved manufacturers.
2. Any proposed substitution in whole or part, must be submitted for review and approval including detail of any difference in price for materials and labor.
3. Any proposed substitutions shall conform to the Contract Documents. Supply proof acceptable to the Owner in the form of a written guarantee that the substituted product(s) meet or exceed the Specifications. The substitution must be accepted in writing by the Owner.

B. Deviations

1. Any deviations or changes involving extra work are not permissible without prior review and written approval by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. New, bearing label of Underwriter's Laboratories, or other testing laboratory acceptable to authority having jurisdiction, where labeling exists for the class of equipment.

B. Provide equipment of one manufacturer, alike in appearance and function.

C. For equipment specified by manufacturer's number, include all accessories, controls, etc., listed in catalogue as standard with equipment. Furnish optional or additional accessories as specified or as necessary to provide a fully functional system.

D. Equipment and material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new. Variance from this permitted only with written approval.

E. Provide an authorized representative to constantly supervise Work specified in this Division; check all materials prior to installation for conformance with Drawings, Specifications, and reviewed Shop Drawings.

F. Any item not specifically shown on the drawings or called for in the Specifications, but normally is required to conform to the system design intent as presented, are to be considered as part of the Contract and required to be furnished and installed by the Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer's Directions: Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and leveled with supports neatly placed and properly fastened as shown and specified. Provide means of bringing in and installing equipment into position inside building.

C. Comply with NECA 1.

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

H. Sleeves, Chases and Concrete Inserts:

1. Provide sleeves, chases, concrete inserts, anchor bolts, etc., before concrete is poured.
2. Sleeves, chases are prohibited in structural members, except where shown or approved in writing.

I. Cutting and Repairing:

1. Do all cutting, repairing, including structural reinforcing, necessary for Work specified in this Division.
2. Do no cutting or patching without approval. Repair damage done by this cutting equal to original condition in Owner's opinion.

3.2 WASTE DISPOSAL

A. Waste Management: Disposal and recycling of waste shall comply with requirements of Division 1 Section "Construction Waste Management.

3.3 COORDINATION

A. Coordinate arrangement, mounting, and support of specified equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for installed items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with firestopping specified in Division 07 Section "Penetration Firestopping."

3.4 SAFETY:

A. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.

B. The Contractor shall ensure that all personnel working in or anywhere on the site shall be provided a hard hat, safety shoes, a face shield or safety goggles, etc. for their protection.

C. If required by the owner, all personnel working in or anywhere on the site shall display a photo-ID.

D. The Contractor shall ensure that all personnel working in or anywhere on the site shall conform to the owner's regulations regarding confined space.

3.5 DELIVERY, STORAGE AND HANDLING

A. Protect materials and equipment from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

3.6 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROJECT CLOSEOUT

A. The installed Voice Data Communications System will not be accepted until all work is complete and properly documented and all punch list items discovered are completed to the Designer and Owner’s complete satisfaction.

B. The warranty will not begin until after a thirty (30) day acceptance period to judge the performance of the installed Voice Data Communication System. If during this thirty (30) day period the installed system does not perform adequately, the Trade Contractor must repair the installation within two (2) days to the satisfaction of the Designer and Owner and/or the Contract Documents and the thirty (30) days will restart from the date of the resolution.

C. The Trade Contractor’s project manager must be available to answer questions about the installation and to attend site visits and meetings during the acceptance period.

END OF SECTION 270510

SECTION 270526 - GROUNDING AND BONDING FOR STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section covers specific aspects of work that apply to work detailed in each of the following “subsections”:

1. Section 270510 – Common Work Results for Structured Cabling System.

a. Includes Glossary, Definitions, Regulations, Codes, Standards and other common work results that apply also to this section.

2. Section 270536 – Cable trays for structured cabling system.
3. Section 271116 – Structured cabling system cabinets, racks, frames, and enclosures.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications grounding and bonding system

1.3 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. EMT: Electrical metallic tubing.

C. TGB: Telecommunications grounding busbar.

D. TMGB: Telecommunications main grounding busbar.

1.4 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. Conform to all regulations, codes and standards listed in Section 270510

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. TIA-607-B – Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises, including addenda

1.5 ACTION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

1.6 INFORMATION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Chatsworth Products, Inc.
2. Or approved equal.

2.2 TELECOMMUNICATIONS MAIN GROUNDING BUS BAR (TMGB)

A. (Contractor is to verify that TMGB in main comm room is functioning properly and report results to owner. It is not expected that a new TMGB is required)

B. The TMGB shall be electrotin-plated, predrilled copper bus bar with holes for use with standard sized lugs, have a minimum dimension of .25 in. thick by 4 in. wide, and 12 in. length. It must be listed by an NRTL.

C. Hole patterns on the bus bars shall accommodate two-hole lugs per the recommendation of BICSI and TIA-607-B standards.

D. Insulators shall electrically isolate bus bars from the wall, or other mounting surfaces, thereby controlling the current path.

E. Provide required stainless steel hardware to fasten the two-hole ground lugs to the bus bar.

2.3 TELECOMMUNICATIONS GROUNDING BUS BAR (TGB)

A. (Contractor is to verify that TGB in comm room is functioning properly and report results to owner. It is not expected that a new TGB is required)

B. The TGB shall be electrotin-plated, predrilled copper bus bar with holes for use with standard sized lugs, have a minimum dimension of .25 in. thick by 2 in. wide, and 12 in. length. It must be listed by an NRTL.

C. Hole patterns on the bus bars shall accommodate two-hole lugs per the recommendation of BICSI and TIA-607-B standards.

D. Insulators shall electrically isolate bus bars from the wall, or other mounting surfaces, thereby controlling the current path.

E. Provide required stainless steel hardware to fasten the two-hole ground lugs to the bus bar.

2.4 GROUNDING AND BONDING CONDUCTORS

A. Minimum conductor size shall be 6 AWG.

B. Sizing of conductors shall comply with TIA-607-B standards and as required by contract documents.

C. All Telecommunication grounding conductors shall be insulated, stranded, copper conductors.

D. Green-colored insulation.

E. It is expected that the new four-post rack and ladder rack will be bonded to the existing grounding system.

2.5 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

C. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Installation of the Telecommunication Grounding and Bonding System shall be done by a licensed electrician. This includes but not limited to:

1. All bus bars
2. All bonding conductors

3. Bonding to all non-active (non-current carrying) metal support structures, rack, runway etc. within each Telecommunication Room or Space. Coordinate this bonding with the supplier and installer of rack, runway etc.

B. NOTE: The TMGB/TGB is to provide a single point ground reference within the room and IS NOT TO BE USED AS AN AC EQUIPMENT GROUND.

C. The TBB should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in conduit that exceeds 1m (3 ft) in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum.

D. Each telecommunications grounding and bonding conductor shall be labeled. Labels shall be located on conductors as close as practicable to their point of termination in a readable position. Labels shall be nonmetallic and include the information “IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER”. Refer to TIA-606-B for additional labeling requirements.

3.2 BONDING CONDUCTOR

A. Where building steel is available within the room, the TMGB/TGB should be bonded to the nearest structural steel column, provided that it’s bonding effectiveness has been verified via two point bonding testing. This connection would be an acceptable alternative to routing of a Bonding Conductor for Telecommunications (BCT) to the main electrical panel board.

B. A bonding conductor can be routed between TMGB and the nearest effectively grounded AC electrical branch circuit panel board, provided a low ground impedance of the panel board has been verified with a ground impedance tester. This connection would be an acceptable alternative to routing of a BCT to the main electrical panel board.

C. All cabling used to bond grounds are to be tagged with labels with the point of origin and destination i.e. going to/coming from, with printed labels.

3.3 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B.

B. Provide nonmetallic pre-printed labels, white background with black printing that can be permanently mounted to the bus bar.

C. The bonding conductors for telecommunications, TBB conductor, and each grounding equalizer shall be green or marked with a distinctive green color.

3.4 TESTING

A. Contractor shall pay for the services of a qualified testing agency to perform the specified tests.

B. Contractor shall notify the Owner in writing at least 5 working days in advance of performance of work requiring testing.

C. Provide all material required for testing.

D. The tests shall be performed using the two (2) point method test per IEEE No. 81, Section 9.03 to determine the ground resistance.

E. All testing should be done with the entire building in operation. Nothing needs to be shut down to test the grounding and bonding with this tester.

F. Zero the meter using the 500 foot number #10AWG copper test lead. Connect the short test lead from the meter to the close end of the wire/cable under test. Connect the end of the 500 foot lead to the other end of the wire/cable under test. Take the reading of the wire/cable under test.

G. Tests to be conducted:

1. Test between the TMGB and the service equipment (power) ground.
2. Test between the TMGB and each TGB in the system.
3. Test between the TGB and locally grounded equipment:

H. The system resistance to ground in any test should be no greater than 0.1ohm or less unless otherwise specified by engineering design.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with ANSI/TIA-569-D, "Firestopping."

END OF SECTION 270526

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section covers specific aspects of work that apply to work detailed in each of the following “subsections”:

1. Section 270510 – Common Work Results for Structured Cabling System.

a. Includes Glossary, Definitions, Regulations, Codes, Standards and other common work results that apply also to this section.

2. Section 270526 – Grounding and bonding for structured cabling system.
3. Section 271116 – Structured cabling system cabinets, racks, frames, and enclosures.

1.2 SUMMARY

A. Section Includes:

1. Ladder cable trays.
2. Wire-basket cable trays.
3. Single-rail cable trays.
4. Channel cable trays.

1.3 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. Conform to all regulations, codes and standards listed in Section 270510

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 ACTION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. Shop drawings:

1. Indicate tray type, dimensions, support points, and finishes on floor plans.

2. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Delegated design: For seismic restraints.

1.5 INFORMATION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. Coordination Drawings:

1. Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
2. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
3. Vertical and horizontal offsets and transitions.
4. Clearances for access above and to side of cable trays.
5. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

C. Qualification certificates: For seismic performance.

D. Field test reports:

1. Certification of cable tray grounding continuity.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

B. WARNING SIGNS Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

C. SOURCE QUALITY CONTROL Testing: Test and inspect cable trays according to NEMA VE 1.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray of 120 deg F for ambient and 180 deg F for material surfaces.

E. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Chatsworth Products, Inc.
2. Or approved equal.

2.2 LADDER CABLE TRAYS

A. Description:

1. Configuration: Two side rails with transverse rungs welded to side rails.
2. Maximum side rail flange widths: 1 inch outstanding and 1-3/4 inch total.
3. Rung spacing: No more than 12 inches on center.
4. Radius-fitting rung spacing: no more than 12 inches on center measured at center of tray's width.
5. Minimum cable bearing surface for rungs: 7/8-inch width with radius edges.
6. No portion of the rungs shall protrude below the bottom plane of side rails.
7. Materials and finishes for cable tray sections, covers, and fittings:

    a. Pre-galvanized steel: ASTM A1011 SS, Grade 33 for 14 gauge and heavier and ASTM A1008, Grade 33 Type 2 for 16 gauge and lighter. ASTM A653/A653M, Gr. 33 G90 mill-galvanized before fabrication.
    b. Post-galvanized steel: ASTM A1011 SS, Grade 33 for 14 gauge and heavier and ASTM A1008, Grade 33 Type 2 for 16 gauge and lighter. ASTM A123/A123M hot-dipped galvanized after fabrication.
    c. Aluminum: Extruded copper-free 6063-T6 aluminum alloy
    d. Stainless steel: Continuous roll-formed ASTM A240, AISI Type 304/304L or AISI Type 316/316L

8. Environmental compatibility:

    a. Aluminum, pre-galvanized steel, or post-galvanized steel.

9. Materials and finishes for accessories, hardware and fasteners shall comply with manufacturer’s recommendations for specific materials and finishes intended for use with selected cable tray and suitable environmental compatibility.
10. Structural performance of tray and supports shall be capable of, with a safety factor of 1.5, when tested according to NEMA VE 1:

    a. Supporting a maximum distributed load of 0.5 lbs/ft per square inch of usable tray depth by width, plus a single 200-lb concentrated load.
    b. Limiting deflection to a maximum of 1/150 relative to span but no more than 1-1/2 inch total under maximum distributed load.

11. Usable load width: As indicated on drawings.
12. Usable load depth: As indicated on drawings.
13. Tray width: No more than minimum required to support usable load width.

14. Side rail depth: No more than minimum required to support usable load depth.
15. Install expansion connectors where recommended by manufacturer and as indicated on drawings.
16. Provide number of support points spaced and located for sections and fittings:

    a. At each connection point
    b. At ends of each section
    c. As recommended by manufacturer.
    d. As required to meet structural performance requirements

17. Splices shall not be located within the support span.
18. Fitting minimum internal radius: 12 inches.
19. Comply with NEMA VE 1, select designations as required to meet structural performance requirements.
20. Cable tray accessories:

    a. Fittings: Provide tees, crosses, risers, elbows, reducers, and other fittings as indicated on the drawings, as required to achieve a complete and functional system, and as recommended by manufacturer.
    b. Covers: None.
    c. Barrier Strips: As indicated on drawings.
    d. Hardware and fasteners: Provide slice plates, conduit to tray adaptors, end closures, box connectors, clamps, brackets, rods, drop outs, and other accessories as required to achieve a complete and functional system and as recommended by manufacturer.
    e. Grounding and bonding: Provide bonding jumpers and conductors complying with cable tray manufacturer recommendations.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment with following clearances:

1. Side clearance: 12 inches.
2. Top clearance: 6 inches.
3. Continuous side and top clearances shall be maintained for a length of 2ft with no more than 10ft between accessible locations.

D. Remove burrs and sharp edges from cable trays.

E. Fasten cable tray supports to building structure and install seismic restraints.

F. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

G. Construct supports from channel members, threaded rods, and other appurtenances furnished and recommended by cable tray manufacturer.

H. Support assembly to prevent excessive twisting from eccentric loading.

I. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

J. Make any connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

K. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

L. Make changes in direction and elevation using manufacturer's recommended fittings.

M. Make cable tray connections using manufacturer's recommended fittings.

N. Seal penetrations through fire and smoke barriers. Comply with requirements in Division 07 Section "Penetration Firestopping."

O. Install permanent covers, if required, after installing cable. Install cover clamps according to NEMA VE 2.

P. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

Q. Repair any damage to cable tray finishes with methods recommended by cable tray manufacturer in order to maintain warranty.

R. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified.

B. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays may be used to convey grounding only to other cable trays, all other equipment shall be grounded directly as specified in section 270526

D. When using epoxy or powder coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing cable trays survey for compliance with requirements.
2. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
4. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and tighten in suspect areas.
6. Check for improperly sized or installed bonding jumpers.
7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with ANSI/TIA-569-D, "Firestopping."

END OF SECTION 270536

SECTION 270553 - IDENTIFICATION FOR STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section covers specific aspects of work that apply to work detailed in each of the following “subsections”:

1. Section 270510 – Common Work Results for Structured Cabling System.

    a. Includes Glossary, Definitions, Regulations, Codes, Standards and other common work results that apply also to this section.

2. Section 270526 – Grounding and bonding for structured cabling system.
3. Section 270536 – Cable trays for structured cabling system.
4. Section 271116 – Structured cabling system cabinets, racks, frames, and enclosures.
5. Section 271300 – Structured cabling system backbone cabling.
6. Section 271500 – Structured cabling system horizontal cabling.

1.2 SUMMARY

A. Section Includes:

1. Labeling requirements for structured cabling system

1.3 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. Conform to all regulations, codes and standards listed in Section 270510

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 ACTION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration.

C. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

1.5 INFORMATION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. As-built system labeling schedule

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with TIA/EIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.2 FACEPLATE / OUTLET LEGEND

A. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project. Revise Schedule at the end of each phase to show all new cables as well as known existing cables.

B. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA-606-B. Furnish electronic record of all drawings, in software and format selected by Owner. Include all new cables as well as any existing cables that were moved to the new panels/racks as part of the final implementation phase.

C. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA-606-B.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.2 LABELING SCHEME

A. Confirm the labeling scheme with the Owner prior to labeling.

END OF SECTION 270553

SECTION 271116 - STRUCTURED CABLING SYSTEM CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section covers specific aspects of work that apply to work detailed in each of the following “subsections”:

1. Section 270510 – Common Work Results for Structured Cabling System.

    a. Includes Glossary, Definitions, Regulations, Codes, Standards and other common work results that apply also to this section.

2. Section 270526 – Grounding and bonding for structured cabling system.
3. Section 270536 – Cable trays for structured cabling system.

1.2 SUMMARY

A. Section Includes:

1. Equipment racks
2. Cabinets

1.3 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. Conform to all regulations, codes and standards listed in Section 270510

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 ACTION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

B. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

C. Seismic Qualification Certificates: For equipment frames from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.

B. Once ready to install equipment in racks and enclosures, protect and maintain the telecommunications spaces in having minimal dust or construction debris. Ensure all surfaces are wiped down and clean prior to installation of active equipment.

1.8 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment. Coordinate service entrance arrangement with Owner.

1. Meet jointly with all other contractors that have equipment housed within the Telecommunications spaces and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. See Bill of Materials on plan drawings.
2. Or approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.4 EQUIPMENT FRAMES

A. General Frame Requirements:

1. See Bill of Materials on plan drawings.

2.5 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. See Bill of Materials on plan drawings.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Manufacturer's Directions: Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

D. Equipment: Accurately set and leveled with supports neatly placed and properly fastened as shown and specified. Provide means of bringing in and installing equipment into position inside building.

E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

F. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers.

1. Meet jointly with telecommunications and LAN equipment suppliers, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B.

B. Provide nonmetallic pre-printed labels, white background with black printing that can be permanently mounted to the bus bar.

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with ANSI/TIA-569-D, "Firestopping."

END OF SECTION 271116

SECTION 271300 - STRUCTURED CABLING SYSTEM BACKBONE CABLING

PART 1 - GENERAL

1.1 NOT INCLUDED

A. The existing fiber optic and copper cabling backbones between the Main Comm Room and Comm Room will be left in place as is.

B. There are no requirements for new backbone cabling in this project.

END OF SECTION 271300

SECTION 271500 - STRUCTURED CABLING SYSTEM HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section covers specific aspects of work that apply to work detailed in each of the following “subsections”:

1. Section 270510 – Common Work Results for Structured Cabling System.

a. Includes Glossary, Definitions, Regulations, Codes, Standards and other common work results that apply also to this section.

2. Section 270526 – Grounding and bonding for structured cabling system.
3. Section 270553 – Identification for Structured Cabling System

1.2 SUMMARY

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
2. Bridged taps and splices shall not be installed in the horizontal cabling.
3. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal (copper) cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

D. Section Includes:

1. 100-ohm balanced twisted-pair cables, cords, and connecting hardware.

1.3 REGULATIONS, CODES, AND STANDARDS COMPLIANCE

A. Conform to all regulations, codes and standards listed in Section 270510.

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 ACTION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

1.5 INFORMATION SUBMITTALS

A. All submittals as defined in Section 270510 – Common Work Results for Structured Cabling System.

1.6 QUALITY ASSURANCE

A. Structured Cabling Solution shall as a full solution be covered by a complete warranty to guarantee a high performance cabling system that meets application requirements as follows:

1. A Cable Products Warranty shall guarantee all cable installed in the structured cabling system. The Cable shall be warranted for a period of at least lifetime warranty.
2. A Connectivity Warranty shall guarantee all copper connectivity components. The system shall be warranted for a period of at least lifetime warranty.
3. Installer shall comply with all manufacturer qualifications, certifications and installation requirements for full system warranty.

PART 2 - PRODUCTS

2.1 MATERIALS FURNISHED

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. See Bill of Materials on plan drawings.
2. Or approved equal.

2.2 100-OHM BALANCED TWISTED-PAIR CABLES AND CONNECTING HARDWARE.

A. Solution: Category 6

1. Performance Requirements

a. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C when tested according to test procedures of this standard.

b. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
c. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70.
d. Comply with ICEA S-90-661 for mechanical properties.
e. Grounding: Comply with TIA-607-B.
f. Comply with TIA-568-C, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
g. Imprinted with pair count, cable category, and aggregate length at regular intervals not to exceed 40 inches.

B. Cable:

1. UL rating: CMR.
2. Color: Refer to drawings.

C. Connectors and cords:

1. Color: Refer to drawings.
2. Faceplate mounting: Refer to drawings.

D. Faceplate:

1. Style: Refer to drawings, compatible and recommended by manufacturer for use with selected connector.
2. Material: Refer to drawings.
3. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.
4. Configuration and gang type: Refer to drawings.
5. Labeling: Snap-in, clear-label covers and machine-printed paper inserts.
6. Color: Refer to drawings.

E. Patch panels:

1. Mounting: Rack mountable in 19” wide EIA-310-D compliant rack
2. Style: Compatible and recommended by manufacturer for use with selected connector.
3. Construction: Refer to drawings.
4. Rack units: Refer to drawings.
5. Ports per panel: Refer to drawings

F. Cords:

1. Selected cords shall be of the same manufacturer as the connectors.
2. Factory-made, four-pair cable; terminated with eight-position TIA/EIA T568B modular plug at each end.
3. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure same performance as full system. Patch cords shall have latch guards to protect against snagging.
4. Jacket type; PVC.

5. Lengths to be determined at the time of installation based on field measurements. Provide various lengths to ensure a neat installation. See Bill of Materials on plan drawings for bid sizes.
6. Quantity: Provide quantity required to make all cross connects and 10% spare
7. Color: Refer to drawings.
8. Patch Cords are to be proposed as an alternate to the base bid.

2.3 TESTING EQUIPMENT

A. Approved testing equipment manufacturers

1. Horizontal Copper Test Equipment:

a. Agilent Technologies
b. Fluke
c. Ideal Industries
d. Microtest

B. Test instruments and methods shall meet or exceed applicable requirements in TIA/EIA-568-C and Annex E “Guidelines for field-testing length, loss, and polarity of fiber optic cabling”.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Comply with NECA 1, NECA/FOA 301, and NECA/BICSI 568.

B. Comply with TIA/EIA-568 series standards.

C. Comply with BICSI ITSIM, Ch. 6 “Cable Termination Practices."

D. Verify that all cable pathways have been de-burred and properly joined, coupled and terminated prior to installation of cable and report any deficiencies prior to installation.

E. Take due account of the minimum bend radius of all installed cables. No cables shall be installed in a fashion that contravenes either the minimum installed or the minimum under load bend radius of the cable.

F. Bundle, lace, and train all installed cabling not otherwise fully contained in conduit or raceway

G. All cables of different medium, construction, UL rating, or category shall be bundled separately.

H. Do not tie the cables so tightly as to noticeably compress the outer sheath.

I. Install lacing bars and distribution spools as needed to ensure cables do not exceed manufacturer's limitations on bending radii.

J. Install cables parallel with or at right angles to sides and back of racks and enclosures.

K. Make terminations only as indicated on drawings.

L. All cables shall be continuous, with no factory or field splices unless otherwise noted on the drawings.

M. Do not install bruised, kinked, scored, deformed, or abraded cable.

N. Remove and discard cable if damaged during installation and replace it with new cable.

O. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

P. Provide a 10-foot long service loop in the telecommunications room, for each horizontal cable.

Q. Where discontinuous support methods such as J-hooks are allowed and used, ensure cabling maintains a minimum clearance of 8 inches from ceiling and lighting elements.

R. Do not block access to doors, hatches, air dampers, valves, cable trays, junction boxes, conduit entries or similar areas of access.

S. Secure all vertical cable runs to ensure there is no more than 15 feet of unsupported cable using symmetrical conforming non-metallic bushings or woven cable grips appropriate to the weight of the cabling.

T. Cable shall not be run through structural members or in contact with pipes, ducts, or other means that may potentially damage items unless otherwise noted on drawings.

U. Do not run cabling unsupported directly on floor in raised floor construction.

V. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable."

W. Use purpose-built pulling grips during cable installation. Do not pull cables by attaching pull wires to cable jackets, elements or reinforcement.

X. Pulling and laying cable on sharp edges is not permitted.

Y. Monitor cable pull tensions and apply chemically inert lubricant to cables as needed to maintain tension within manufacturer recommendations.

3.2 100-OHM BALANCED TWISTED-PAIR CABLE INSTALLATION:

A. Provide a minimum cable length of at least 49 feet, including service loop if applicable, between termination points. Loop and support any associated required slack within the telecom space or near telecom enclosure as needed.

B. Do not untwist cables more than 1/2 inch from the point of termination to minimize extent of disturbed original cable geometry.

3.3 SYSTEM TESTING

A. A test demonstration day shall be arranged by the cabling contractor for the purpose of demonstrating and agreeing to the test schedule, equipment to be used, and format of results. The test demonstration shall cover all tests to be performed. The Owner and/or Owner's Representative shall be invited to attend this test demonstration day.

1. Perform tests following installation and termination to ensure that the cabling plant and associated components conform to this specification and will perform satisfactorily in service, as determined by the Owner's Representative.
2. Perform any additional tests that are necessary to guarantee a fully functional system.
3. If a component fails a particular test, rectify, rework or replace the component. Re-test the component and associated complete link once the component has been re-worked or replaced. This process shall continue until the component and associated link/channel passes all relevant tests.

B. General Procedures

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C series standards and as specified in this document.
2. Cables and connecting hardware shall as a minimum comply with mechanical and electrical requirements of TIA/EIA-568-C series standards for the type of cable specified on the drawings. All cables and associated permanent links installed, including connectors, shall be individually tested and all test results shall be recorded.
3. All testing procedures shall be performed in accordance with the manufacturers' recommended testing guidelines and the procedures specified herein.
4. The testing shall be done using testing equipment approved by the cabling system manufacturer.
5. The Owner shall have the right to inspect and monitor any or all of the field tests.
6. The testing is to show that beyond reasonable doubt there are no errors, damaged or incorrectly installed components, the installation is correctly labeled, and all the installed components meet or exceed the criteria detailed in these specifications. Any test that does not show that a component is satisfactorily installed, as per these specifications, shall be repeated. If a test procedure needs to be modified to satisfactorily test some components, this shall be discussed between the owner's representative and the installer, prior to the tests being conducted.
7. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to testing. Any testing performed on incomplete systems shall be redone on completion of the work
8. Notify the Owners' Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration and the names and qualifications of test personnel.

9. The Owner and Owners Representative shall be invited, at reasonable request, to the first of each type of test conducted. This is to minimize the risk that the tests being conducted do not meet these specifications. In the event of a number of tests being conducted by the installer prior to this first inspection, the owner's representative reserves the right to reject these tests as non-compliant and to call for them to be repeated at the installer's cost.
10. Personnel shall be competent in and qualified by experience or training for comprehensive Time Domain Reflectometer (TDR) and Optical Time Domain Reflectometer (OTDR) operation and troubleshooting, for copper and optical fiber testing.
11. Ensure that all test equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status is carried out.
12. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.
13. Sign and date each successful series of test results as the tests proceed.
14. The test documentation shall be available for inspection by the Owners' Representative during the installation period and the original documents (not copies or re-typed versions) shall be passed to the Owners' Representative within 5 working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.
15. If there are any missing test results or incorrectly named files, the test shall be repeated at the Installer's expense
16. Failures detected during the testing shall be duly noted on the test results schedule, rectified and retested. On the retest the result schedule fault being rectified shall also be noted. These notes shall not be deleted or obliterated.
17. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices or distribution points will not be acceptable except where specified in this document. All damaged cables shall be removed from site.
18. The Owner shall reserve the right to hire a third party testing crew to conduct random verification of testing results.
19. If any of the random retested result in a "FAIL", the owner has a right to request a 100% retest, and to have a representative present for that retest
20. This re-testing will be performed in the presence of the Owner or its duly authorized representative. This request will be given to the Contractor with two days prior notice and shall be performed at no additional cost to the Owner.
21. The Owner reserves the right to refuse payment for testing services if random testing does not meet the Owner's criteria of a 100% match to the original test results.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable management operation, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with ANSI/TIA-569-D, "Firestopping."

END OF SECTION 271500

SECTION 275223 – NURSE CALL SYSTEM
(This Section has been revised in its entirety in OSHPD BC4)

PART 1 - GENERAL

1.1 OVERVIEW

A. Provide a complete working Nurse/Patient Communications Network based upon the specification outlined here to include all necessary devices that provide the functions listed in this specification for Natividad Medical Center Building 500 Radiology Modernization project. This facility will be referenced as the Owner in this specification.

B. If an operational function is specified that requires hardware or software to complete that specific function, then consider that software or hardware part of this specification.

C. All Nurse Communications Network devices shall be UL-1069 listed. This includes routers, hubs, switches, and room control devices. The nurse call network shall be an FDA Registered Class II (or higher) medical device and the system's manufacturer shall be an FDA Registered Operator. Field wiring shall be CAT 5E cable, control wiring for power distributions and very long runs, and utilize an optional fiber backbone (when distances exceed normal Ethernet limitations). All station equipment shall use plug on connectors and all switches, routers and controllers shall utilize standard RJ-45 modular connections. All remote devices utilizing standard structured cabling shall be capable of PoE (Power over Ethernet) or power supplied within the CAT 5E cable jacket. Systems which require separate DC power to devices, remote power supplies, or heavy DC wiring to each individual room shall not be accepted. Wiring shall be capable of either being installed in conduit or cable trays, where shown on the plans. Nurse Communications cabling may be run along with other low voltage and data cables where permitted by code. Nurse Communications cabling to be separated out from any high voltage AC or DC wiring that exceeds 90 volts, or which violates any national or local electrical code.

D. The system must be UL 1069 listed as a Nurse Communications Network. Systems listed by other nationally recognized testing laboratory may not be accepted.

E. All devices and components that comprise the Nurse Communications Network shall be compliant to the European Union's Directives as specified in Section 1.03 References. The manufacturer's signed Declaration of Conformity document stating compliance to the directives shall be available upon request.

F. Overall Nurse Communications Network shall utilize VoIP communications between all major components: nurse consoles, staff terminals, and controllers. Any nurse call console and staff terminal must be able to answer any patient call placed in the network. Systems not utilizing the VoIP standard will not be acceptable.

G. The Network shall be expandable to any combination of over 15,000 bed, duty, or staff stations and 120,000 sub-stations connected as a contiguous interconnected system. Multiple buildings and intra-building connections may be linked together utilizing a fiber or an Ethernet connection. Audio communications between devices shall be digital and virtually non-blocking, so as to provide fast, instantaneous communications without queuing or delay.

1.2 SCOPE

A. Natividad Medical Center Building 500 Radiology Modernization project is replacing the current Fisher Berkeley nurse call system with an Owner purchased new Rauland-Borg Responder 5 Nurse Call network.

B. The Network may be expanded in the future to the remaining nursing units as determined by Owner.

1.3 REFERENCES

A. Underwriter's Laboratories UL-1069 current release

B. Canadian Standards Association

C. National Electrical Code

D. NFPA 70 and 99

E. U.S. Dept. of Labor / Occupational Safety and Health Administration

F. State Hospital Code / Joint Commission of Hospitals – Nurse Call Requirements

G. NEMA installation standards

H. European Union's DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, commonly known as the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) or RoHS

I. European Union's DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, commonly known as the Low Voltage Directive (LVD)

J. European Union's DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, commonly known as the Electromagnetic Compatibility Directive

1.4 QUALIFICATIONS

A. Authorized Distributor for product supplied. Authorized Distributor Letter from manufacturer required upon request of specifying authority.

B. Applicable state contractors licenses. Copy available upon request.

C. Certificate of successful completion of manufacturer's installation/training school for installing technicians of the equipment being purchased by Owner. Letter from manufacturer stating technician qualifications on request.

1.5 SYSTEM DESCRIPTION (All equipment provided by Owner)

A. System hardware shall consist of a nurse call network comprised of VoIP nurse consoles, nurse call network controllers, patient stations, power supplies, battery back-up, dome lights, call cords, pull cord stations, emergency push button stations, VoIP staff terminals, and wiring. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse/patient communications network.

B. System hardware and firmware shall be the product of a single, reputable manufacturer with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of one year from date of installation for any product feature enhancements. Manufacturer shall provide a 5 year warranty on all manufactured hardware. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a VPN connection. Any supplier whose equipment cannot support remote system configuration programming and diagnostics via VPN or requires the exchange of parts, chips for system configuration programming changes will not be acceptable.

C. All programming and firmware changes shall be accomplished on a working system without interruption to the normal operation of the system. Therefore, all system switches and controllers, which hold this firmware and system parameters must have DUAL storage. While updates are being made to one set of firmware, the system shall be working and fully functional on the original firmware (i.e. A and B memory blocks). It shall be possible to switch to the NEW system control software modules by a single system command. In the event of an error or failure in the update process, the system shall revert back to the previous firmware.

D. All communications shall be full duplex audio, not only on handsets, but all loud speaking devices, including patient, duty, and staff terminals. Systems that do not have full duplex audio or do not have separate microphone and speaker capability within the pillow speakers will not be accepted.

E. All wall mounted stations shall be flush mounted using snap tight cover plates. Sub plates shall be slotted and adjustable for trimming the mounting for "squaring" the vertical and horizontal fit. All screws shall be hidden.

F. All flush mount station buttons shall have the option for a bio-seal cover to facilitate the use of disinfectant cleaners.

G. Entire Network shall be supervised, including all sub-stations. Reporting of station failure shall be to any designated console, PC, e-mail, or wireless device. Remote diagnostics shall be utilized to quickly locate the source of the problem.

H. Up to 99 different staff levels may be defined within the nurse call network to facilitate work flow within and outside of normal nurse call activity (i.e. environmental services, facilities, transportation, lab, pharmacy, etc.).

I. Nurse call network shall support a VLAN configuration to separate activity in the nurse call network from other hospital LAN traffic.

J. All specified equipment shall be manufactured using surface mount technology (SMT) and manufacturing testing shall utilize ATE (Automated Test Equipment) to assure the highest quality production. Specifying authority may request test procedures and/or results of tests on specific equipment being supplied. Manufacturer's testing procedures must be available upon request, including test equipments model number, serial numbers and date of last calibration.

K. The nurse call network shall support at least 990 call processes to facilitate work flow and call escalations to various staff and or groups.

1.6 SUBMITTALS (Included as reference)

A. Any supplying contractor proposing equipment, not supplied by the Owner, which is not the base standard for this specification must provide full submittals at the time of bid. This option shall be exercised at the discretion of the Owner/specifying authority.

B. The supplying contractor shall submit (3) three complete submittal sets. These sets are to be submitted electronically, in a three ring binder, a continuous spiral binder, or plastic binding that allows the booklet to lie flat while open. Each booklet shall consist of the following:

1. Page 1: Name of supplying contractor, project name, and OSHPD number.

2. Page 2: In the following order, a listing of: equipment manufacturer, model number, and description of each component being supplied. If equipment being supplied is not the specified equipment manufacturer's model, alongside the submitted model number and description, list the specification paragraph that corresponds to the equivalent specified model. Failure to provide this information will result in the rejection of submittals.

3. Page 3: One catalog sheet per product of equipment listed on Page 2; in the exact order as listed on Page 2. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include a photograph of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. Submittals that are not of adequate clarity or content may be rejected.

4. Separate: Provide all inter-equipment wiring diagrams and drawings necessary to install the equipment being supplied. These drawings will show all wiring types by wire gauge, conductors and wire manufacturer. These drawings must be updated prior to completion of any work to reflect changes that may have been made during actual installation.

C. In the event the specifying authority decides to reject the submittals of a supplying contractor, the specifying authority may ask the contractor to re-submit if the discrepancies are minor. Otherwise rejection of submittals means the specified product must be supplied. Decisions of the specifying authority are final.

1.7 QUALIFICATIONS

A. Manufacturer - [Company specializing in manufacturing the Products specified in this Section with minimum 3 years documented experience and with service facilities within 100 miles of Project].

B. Supplier - Authorized distributor of specified manufacturer with minimum 3 years documented experience.

C. Installer - Determined on per job basis: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

1.8 PROJECT SITE VISIT

A. It is the responsibility of all prospective contractors to make an adequate inspection of the project site. A mandatory site visit is required. Any contractor not registered as having attended the mandatory site visit tour will be disqualified and any bid proposal will automatically be rejected.

1.9 WARRANTY

A. The supplying contractor shall provide a warranty on the system which shall include all necessary labor and equipment to maintain the system(s) in full operation for a period of one year from the date of beneficial use by nursing unit.

B. Manufacturer shall provide, free of charge, product firmware/software upgrades throughout the 1 year warranty period for any product feature fixes.

C. In addition, the equipment (parts) warranty for all core system components including control / switching equipment, power supplies, patient stations, sub-stations, and nurse consoles shall extend to a total of at least five (5) years. Warranty for ancillary devices such as call cords shall extend to a total of at least two (2) years.

D. After the acceptance of the system(s), service shall be provided on the following basis:

1. Emergency Service

a. Provided 24 hours a day. When a total or catastrophic failure of equipment is reported to contractor, within 3 hours of notification, a service person will be on site. (An example of a catastrophic failure would be a hub failure or a nurse console failure.)

2. Routine Service

a. Provided within 4 business hours (9 a.m. to 5 p.m., Monday through Friday, excluding holidays) of notification. When a minor failure of equipment is reported to contractor, a service person will be on site within 24 hours of notification. (An example of a minor failure includes peripheral equipment such as control stations, entertainment speakers, corridor lights, pull-cord stations, etc. which normally affect only one patient or patient room.)

1.10 MAINTENANCE

A. The Owner may choose to have the installing contractor maintain the system(s). All labor and equipment costs would be covered under a separate maintenance contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The products provided by the Owner shall be new and of the standard manufacture of a single reputable manufacturer. As a reference of standard and quality, functionality and operation, it is the request of the Owner that installation bids be based only on equipment supplied by the Owner; manufactured by Rauland-Borg Corporation.

2.2 REMOVAL OF EXISTING PRODUCT

A. Remove all existing product and deliver to the Owner, or at the direction of the Owner, properly dispose of same.

B. Per National Electrical Code, remove all unused or “dark” wiring utilized by the removed nurse call system.

C. The Owner will continue to occupy some areas of the nursing unit where equipment will be replaced. Drawings may show intended phasing work however coordination with construction team for room and corridor access is required. A temporary nurse call system utilizing surface mount boxes and cable shall be established in areas as shown on the drawings prior to any demo of the existing nurse call system by the contractor. The existing nurse call equipment shall then be removed and replaced with new Rauland-Borg Responder 5 devices. The new Rauland-Borg Responder 5 devices shall be installed in existing nurse call rough-in where possible. Any rough-in location not suitable for reuse or any new rough-in shall be installed by contractor.

2.3 NURSE CALL NETWORK WIRING (supplied and installed by contractor)

A. All Nurse Call Network wiring shall be only CAT 5E. Plenum wire shall be used in all areas. System shall be capable of injecting DC power into a CAT 5E for additional rooms, or long runs, by running a separate DC cable pair to a remote location.

2.4 NURSE CALL CONTROLLER(S) (supplied by Owner; installed by contractor)

A. Furnish as needed in each nursing unit a nurse call network controller. Each controller shall provide the following:

1. Non-blocking, duplex communications between consoles and rooms and audio sub stations within each 6 station loop. Provide four loops for a total of 12 dynamically allocated speech paths.

2. CAT 5E wiring standard utilizing PoE (Power over Ethernet) between console and nurse call controllers and local wiring to power room station equipment and dome lights.

3. VoIP audio to Nurse Call Network, VoIP Nurse Console, VoIP staff terminal, wired or wireless phones via SIP protocol. VoIP digital audio stream out to rooms without IP overhead signaling.

4. Up to 96 corridor lights can be operated with a single controller.

B. Controller must be life safety grade meaning that it shall not require regular rebooting for continued basic functions of system and it shall be possible for controller to act as a stand alone controller should loss of network communication occur. Personal Computers may not be used for this purpose. PCs will only be allowed outside of the UL-listed nurse call network on the customer supported LAN.

C. Nurse call controller(s) are connected to the hospital's LAN via Ethernet switches. If option purchased by Owner, the nurse call servers will also connect to the hospital's LAN running specialized software for using hospital data resources and telephone communications resources.

2.5 VoIP NURSE CONSOLES(supplied by Owner; installed by contractor)

A. Furnish as shown on plans, a UL-1069 listed VoIP nurse console capable of the following functions:

1. Full duplex audio

2. Color display

3. 12 or 24 hours time display and synchronization to hospital standard network time from the nurse call gateway server including any daylight savings time changes supported by the network.

4. Display up to 3 incoming calls each with an individual elapsed timer which increments time since call was placed. Also provide the ability to scroll to see more incoming calls.

5. Power over Ethernet powered connection to UL-1069 listed Ethernet controller. No local power supplies required.

6. Choice of hands-free duplex communications through built in speaker and separate microphone or private handset conversation.

7. Ability to create up to 32 soft keys, user-configurable, with 4 buttons, 8 screens deep.

8. Optional tone/mute of calls in progress.

9. Ability to swing an individual room or any group of rooms by touching one labeled touch point. Room(s) and consoles may be located anywhere within hospital nurse/patient communications network.

10. Console can be programmed to be the receiver of any call that is not answered by another console, or can be programmed to receive any call from a console that has failed or has been unplugged, or otherwise not receiving the call (call orphaning).

11. Ability to dial through built in key pad.

12. Self-contained unit which shall not occupy more than 88 square inches of desk space and is desk or wall-mountable.

13. Support manual Staff Follow functions. When Staff Follow is enabled, call-tones for a prescribed area will automatically be forwarded to the room station speaker where staff members are located. Staff location may be determined manually by entering the room number into the console. Pressing the call button on that station shall silence the tones. When a new call is placed, the tones shall automatically be restored.

2.6 VoIP STAFF TERMINAL (supplied by Owner; installed by contractor)

A. Furnish as shown on plans, as part of the nurse call communications network, a UL 1069 listed VoIP Staff Terminal. This dynamic device shall serve as a patient or procedure room communications tool while providing staff with “soft” touch-points to initiate an instantaneous notification of an in-room need. Additionally this terminal may be used as a functional nurse call console.

B. The following functions shall be provided:

1. Color touchscreen display.

2. Ability to create up to 60 soft keys, user-configurable, up to 8 screens per terminal.

a. Sends specific need for that location. Examples: Emergency, Staff Assist, Cleaning Needed, Lifting Help, Transport, Order, Stat Order, Rounding, etc.

b. Speed dial to any location

3. Power over Ethernet powered connection to UL-1069 listed Ethernet switch. Local power not required.

4. Full duplex audio

5. Hands-free duplex communications through built in speaker and separate microphone.

6. Display up to 3 incoming calls each with an individual elapsed timer which increments time since call was placed. Also provide the ability to scroll to see more incoming calls.

7. Ability to dial through touch key pad.

8. Ability to capture an individual nursing unit, selected units, or all units in hospital by touching single custom labeled touch point.

2.7 PATIENT STATIONS (supplied by Owner; installed by contractor)

A. Provide single patient station as shown on plans.

B. Each patient station shall be capable of the following functions:

1. Separate speaker and microphone for full duplex audio. Entertainment audio to be muted when intercom in use.

2. One DIN pillow speaker receptacle per bed that shall have a tilt design, with automatic release of pillow speaker plug when pillow speaker cord is pulled at any angle.

3. Station shall support an optional module to feature bed side rail control on station to indicate the bed is disconnected. LED on station shall indicate that the bed is disconnected and that a bed out call is active.

4. Built in lighting control that interfaces directly to low voltage controllers.

5. One universal 1/4” jack for auxiliary alarm input/call cord per bed. Call priority of these receptacles shall be independent of any other button or receptacle.

6. No dummy plugs required.

7. Cancel button shall cancel any call on this station and any other station in room that is programmed for universal room cancel.

8. Continuous supervision.

9. Ability to service exchange station “hot” without removing system power or powering down the local controller.

10. Ability to program on a per patient station basis, each bed and entertainment/call cord receptacle to custom call priorities.

11. Unit shall mount in a standard 3-gang electrical box.

2.8 DUTY STATION (supplied by Owner; installed by contractor)

A. Provide as shown on plans a duty station. Unit shall provide remote annunciation of assigned patient stations and sub-stations via 4 LED’s and multiple call tones. Duty station faceplate LED’s shall mimic corridor light activity for the assigned nursing area. Also provides two-way duplex intercom to the assigned nurse console(s) through separate speaker and microphone. Call tones generated at duty station must be identical and repeat in synch with tones produced at closest nurse console. It shall be possible to mute the call in tone, without cancelling call. The next call in, assigned to this duty station, will un-mute the station. Muting feature may be defeated in those jurisdictions that do not allow muting of duty station. The duty station shall be capable of being programmed for a specific time that a day/night mode takes place, allowing a volume change to the call-in tones. This feature is required to minimize noise for patients. Unit shall mount in a standard 3-gang electrical box.

2.9 SUB-STATIONS (supplied by Owner; installed by contractor)

A. Provide as shown on plans, sub-stations which shall be flush mounted in a single gang box. All sub station cancel buttons will follow the cancel policy as defined in the system configuration. Typically canceling a high priority call can only be accomplished by the station initiating a call, while lower priority calls may be cancelled by any associated station in the room.

B. Individual sub-stations shall be:

1. Pull cord station with Speaker shall have a replaceable PVC pull-cord with a large easy to pull plastic “bell” attached and easily cleaned surface. The pull-cord shall have and one extra pushbutton for call-in. This button shall be programmable separately from the pull-cord to indicate a different call process (i.e. call caregiver to return to bed) than the pull cord which may indicate an emergency situation. The station shall include a built in speaker and microphone for communications with the patient. Although this station trims out to a double gang faceplate, the mounting is in a single gang box.

2. Dual Call button stations shall be water resistant. The buttons shall be back lit and have the ability for a user defined customized call label corresponding to the 990 call priorities available within the system.

3. Dual call button station can have an optional Clear Cover to prevent accidental initiation of the call buttons. Clear Cover is easily lifted to access buttons and does not cover the Cancel button for easy cancelation of calls.

4. Provide where noted a Logical Input Station which allows any dry contact closure from an external device to activate a call into the nurse communications network.

2.10 CORRIDOR LIGHTS AND DOMELESS CONTROLLERS (supplied by Owner; installed by contractor)

A. Provide as shown on plans, the proper type of corridor light or domeless controller. Corridor lights shall contain four sections, each lighted by a long life, RGB LED capable of producing 7 colors. Each section shall have a diffusion lens which allows for 180 degree horizontal visibility of call lights. The corridor lights shall be capable of the following:

1. All segments of corridor light can indicate a call in any of the following 7 colors: Blue, Red, White, Green, Orange, Yellow, or Pink.

2. Custom call patterns (any combination of light segments, such as all segments blue for code blue).

3. Flash any single color or strobe the sections of the light in any color pattern.

B. Intelligence in the corridor light and domeless controller shall support up to 16 room devices and allow for the ability of any room station to be associated with any other room in the system. This allows special functions where needed, such as associated call stations and cancelling options, (i.e. door monitoring).

C. Domeless controllers shall have all the function of the corridor light, less LED’s.

D. In the unexpected event of communications loss with the nurse call controller, corridor lights and domeless controllers shall enter a local room failsafe mode showing all calls in the hallway via the LED indicators.

E. Corridor lights and domeless controllers may be hot-swapped on the room-to-room communication line without the loss of communications to other devices on the local network.

2.11 PATIENT CALL CORDS (supplied by Owner; installed by contractor)

A. Provide one (1) call cord per patient station. The call cord shall have a mating 9 pin DIN plug and nurse call button.

PART 3 - EXECUTION

3.1 SUPERVISION

A. Only factory certified installers shall install, service, and maintain the specified network system.

3.2 NEEDS ASSESSMENT

A. Contractor shall provide a Nurse Call Orientation meeting that educates key clinical staff that will be using the nurse call system on the specific hardware (and integrations) they purchased. This includes typical associated workflow processes for those devices. Meetings shall include reviewing the floor plan drawing, gathering details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect the training. Information gathered will be provided to Contractor to program the network software as well as being used for In-service Training.

3.3 IN-SERVICE TRAINING

A. Contractor shall provide thorough training of all nursing staff assigned to those nursing units receiving needs assessment of new networked nurse/patient communications equipment. This training shall be developed and implemented to address all types of staff determined at the needs assessment.

3.4 WIRING

A. Contractor shall terminate all wiring with manufacturer approved connectors. The use of wire nuts is prohibited.

B. All wiring shall be free from shorts and faults. Wiring shall be UL listed, NEC and NFPA 70, Article 25 approved.

C. Nurse patient communications network wiring shall not be run in the same conduit with other systems (i.e. Class 1 AC power distribution, fire alarm, entertainment systems, lighting controls, etc.).

3.5 DRAWINGS

A. Provide as built drawings in digital and PDF format of all installed network components and associated wiring on building plans.

END OF SECTION 275223

SECTION 283100 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire alarm and smoke detection system.

1.2 DESCRIPTION

A. Provide all labor, equipment, materials and services to design, furnish. Install and test a complete addressable and intelligent fire alarm system as described herein and as shown on the plans. Fire Alarm system shall be manufactured to match existing Campus fire alarm system. Provide connections to existing Campus Fire Alarm System. Include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of these specifications, whether specifically itemized herein or not.

B. The new fire alarm system shall be design, provided, programmed and tested

1.3 EXISTING SYSTEM OVERVIEW

A. The existing fire alarm system utilizes addressable technology initialing and control devices. Occupant notification throughout the hospital comprises of chimes and visual notification appliances.

B. A campus graphic annunciator is located at the entrance to the hospital on Renova Drive. This annunciator identifies the individual building reporting a fire alarm event and is for the sole use of the San Jose Fire Department.

C. Each building on the campus reports fire alarm, supervisory and trouble signals individually to the Santa Clara County MAC Room and Sonitrol, through the use of Digital Alarm Communicating Transmitters (DACT's) manufactured by Radionics, Model 9412 or equivalent.

1.4 SYSTEM REQUIREMENTS

A. The fire alarm control panel shall be located within the designated fire command room within Bed Building 1. The fire command room within this building shall be configured to support the fire alarm / life safety functions solely for Bed Building 1.

B. Multiple fire alarm control panels may be necessary to provide distribution of power and circuits necessary to support the devices and appliances within this building. The quantity of remote fire alarm control panels shall be determined by the fire alarm system provider and the available space within designated electrical rooms. All XLS panels within this building shall be configured to function as a single system for Bed Building 1.

C. The Signaling Line Circuits (SLC) for the addressable initiating and control devices shall be provided on a per floor basis. A SLC shall not serve more than one floor of the building. Notification circuits shall not be initially loaded in excess of 75 percent of its rated ampere capacity.

D. Power supply shall be 120 volts, 60 Hz from the Life Safety branch. The 24 volts, DC power for all system supervisory and control functions shall be provided by the Main Fire Alarm Control Panel power supply.

E. Signal Line circuits shall be of Style 4 operation.

F. Notification Circuits shall be of Style Y operation.

1.5 INTERFACE WITH THE EXISTING CAMPUS NETWORK

A. The fire alarm system for Bed Building 1 shall interface with the existing campus fire alarm system between existing node 1 (Building E – basement) and either nodes 7 or 8 (Building M – 1st floor), maintaining the style 7 network configuration. Modification to the existing fire alarm control panel nodes 1 – 8 may be necessary to support the addition of the XLS panels on to network. Modifications may be limited to firmware upgrades to the existing nodes, but may also include CPU and Display upgrades. Upgrade to the existing nodes shall be completed and tested prior to the pre-testing of the XLS control panels.

B. An upgrade to the existing campus graphic annunciator, located on Renova Drive shall be required as part of this project. The upgrade shall include a new silk screen display and additionally alarm LEDs for the new buildings. Programming and control for activation of the new building alarm LEDs shall be provided through existing node 7.

C. The Network Command Center (NCC) located within the Protective Services Office will require upgrade as part of this scope of work. The upgrade shall include but not be limited to the modification of the campus maps and individual device assignment to specific device type icons to be displayed. The formatting of the changes shall be consistent with the existing graphical format.

D. The fire alarm system for Bed Building 1 shall report to the Santa Clara County MAC Room and to Sontirol upon final acceptance of the owner. A Radionics, model – 9412 DACT with Keypad shall be provided as part of the new fire alarm system installation. Prior to final acceptance by the owner, the fire alarm system may be required to be monitored by an independent company. The programming and temporary monitoring service shall be included as part of this project scope. Connection to the Santa Clara County MAC Room shall be coordinated with the Santa Clara County Fire Marshal's Office.

1.6 SEQUENCE OF OPERATION:

A. The activation of any alarm, security, supervisory, trouble or status initiating device shall cause appropriate indications at the Person Machine Interface using basic graphics and multiple display screens and alphanumeric displays. The system shall also send the relevant information to be displayed at the Network Command Center (NCC) in the Fire Command Room or other 24/7 operated area.

B. On any alarm activation, the following shall happen:

1. Sound audible alarms on all floors.
2. Activate visual alarms on all floors.
3. Sound an audible alarm and display custom message in fire alarm control panel defining the building in alarm and the specific alarm point initiating the alarm.
4. Display alarm information on an LCD display of a remote annunciator at a location shown on the Drawings.
5. Log the system history archives with all activity pertaining to the alarm condition.
6. Print alarm condition on system printer.
7. Alert the Central Monitoring Station.
8. Audible alarms shall be silencable from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

C. The activation of any fire alarm manual pull station, waterflow switch, or automatic detector circuit shall cause the following to happen:

1. All actions in E.2 above.
2. Release of all door holders and roll-down fire doors on the floor of alarm.
3. Unlock all security doors on the floor of alarm.
4. The activation of elevator lobby, elevator machine room or elevator shaft smoke detector shall also return the elevators in that bank to the primary floor. Activation of smoke detector in the elevator lobby on the primary floor shall return elevators in that bank to the alternate floor as required by local fire department requirements.
5. The activation of an elevator machine room or elevator shaft heat detector shall also shunt trip the circuit breaker(s) serving that elevator(s). The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in the respective locations to insure that the power is shut off before sprinkler activation.
6. The activation of a duct smoke detector at an air handling unit shall also shut down the associated air handling unit.
7. The activation of any smoke detector shall also close all fire/smoke dampers in smoke zone of alarm.
8. The activation of a patient room smoke detector shall also light an isolated red lamp in the dome light outside the room and activate an audio/visual signal at the nearby nurses' station. Coordinate with nurse call system.

D. On any supervisory activation, the following shall happen:

1. Display the origin of the supervisory condition at the local fire alarm control panel.

2. Activate supervisory audible and dedicated visual signal on the fire alarm control panel.
3. Audible signals shall be silencable from the control panel by the supervisory acknowledge switch.
4. Record within system history the initiating device and date and time of occurrence of the event.
5. Print supervisory condition on system printer.

E. On any trouble activation, the following shall happen:

1. Display the origin of the trouble condition at the local fire alarm control panel.
2. Activate trouble audible and dedicated visual signal on the fire alarm control panel.
3. Audible signals shall be silencable from the control panel by the trouble acknowledge switch.
4. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.
5. Record within system history the initiating device and date and time of occurrence of the event.
6. Print trouble condition on system printer.

F. Upon loss of building power the entire system shall operate on battery power for 4 hours and then be capable of sounding all signals for 5 minutes.

1.7 SUBMITTALS

A. Fire Alarm Drawings and Equipment Specifications are part of the OSHPD Permit Submittal Set, see FA drawing series.

1.8 REGULATORY REQUIREMENTS

A. All equipment, wiring, and operation of the system shall comply with local and national codes and ordinances as adopted by local authority having jurisdiction. Specific reference is made to:

1. Underwriters Laboratories listing and labeling of equipment.
2. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems
3. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems
4. UL 268A – Standard for Smoke Detectors for Duct Applications
5. UL 1971 – Standard for Signaling Devices for the Hearing Impaired
6. UL 464 – Standard for Audible Signal Appliances
7. UL 1076 – Standard for Proprietary Burglar Alarm Units and Systems
8. California Building Code
9. California Fire Code
10. California Mechanical Code
11. California Electrical Code
12. National Fire Protection Association
13. NFPA 72 – National Fire Alarm Code
14. NFPA 99 – Requirements for Healthcare Facilities

15. NFPA 101 – Life Safety Code
16. California Office of Statewide Health Planning and Development (OSHPD)
17. Other Codes Referenced
18. NFPA 13 Sprinkler Code
19. NFPA 110 Emergency & Standby Power Systems (For Fire Alarm Systems)
20. Americans with Disabilities Act and 1998 ADA Accessibility Guidelines.
21. Requirements of the local fire department.

B. Any deviation from the regulatory requirements must be approved by the authority having jurisdiction.

1.9 QUALIFICATIONS

A. Manufacturer:

1. Siemens Building Technologies – Hayward, CA.

a. Siemens Building Technologies shall provide the services of a factory trained and certified technician, experienced in the installation and operation of the type of system provided. The technician shall be licensed where required by state law. The technician shall supervise the installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the Owner's personnel in the operation and maintenance of the system.

B. Installer:

1. Installer shall possess and submit documentation of having all required licenses and bonds required by the State of California.
2. Installer shall employ on staff a minimum of one NICET Level II technician or professional engineer registered in the State of California.
3. Installer shall be qualified by Underwriters Laboratories for certifying fire alarm systems. Upon completion of the installation, installer shall certify that the system has been installed in accordance with code requirements and the specifications.

1.10 OPERATION AND MAINTENANCE MANUAL

A. The Contractor shall provide the Owner with a loose-leaf manual containing:

1. A detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, and intended sequence of operations.
2. A point list in booklet form showing point IDs for each point in the system.
3. A detailed description of routine maintenance required or recommended, or as would be provided under a maintenance contract including a maintenance schedule and detailed maintenance instructions for each type of device installed.
4. Manufacturers' data sheets and installation manuals/instructions for all equipment installed.
5. A list of recommended spare parts.
6. Service directory, which includes the main 24-hour emergency service number, and at least three alternate numbers, which are monitored on a 24-hour basis.

7. Small scale (11 inches by 17 inches) contractor record drawings of the system to be included in the final Operation & Maintenance Manual.
8. Small scale (11 inches by 17 inches) system drawings showing only building backgrounds, fire alarm devices, and major panels or equipment.
9. A detailed description of the operation of the system, including operator responses. The approved sequence of operation shall be placed in, or adjacent to, the operator's control panel.

B. It is intended that this manual will be updated during the course of the overall project to include work in future phases and to consolidate existing system components into one manual.

C. Within 60 days after authorization to proceed, the Contractor shall submit to the Owner four (4) copies of the draft manual for approval.

D. Within 30 days prior to the completion of Phase 1, four (4) copies of the approved manual shall be delivered to the Owner.

E. Provide Operation and Maintenance Manual contents on a properly formatted and indexed CD.

1.11 CONTRACTOR RECORD DRAWINGS

A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the fire alarm system from the original approved shop drawings. The Owner shall not construe this as authorization to deviate from, or make changes to, the shop drawings approved without written instruction from the Owner in each case. This set of drawings shall be used only as a record set.

B. Upon completion of the work, the record set of prints shall be used to prepare complete and accurate Final Record drawings reflecting any and all changes and deviations made to the fire alarm system.

C. Upon completion of the work, two sets of blue or black line Record drawings and updated AutoCAD Release 2000 (or higher version) files on CD shall be submitted to the Owner for review. In addition to the Record drawing requirement upon completion of the project, Contractor shall provide the original drawings used by the installers, showing all original notations, routings, and details as noted by the installer.

D. Upon review of the blue or black line Record drawings before final approval, one (1) updated CAD files package on CD, and four (4) sets of blue or black line Record drawings shall be delivered to the Owner.

E. The Contractor Record drawings are required to show, and to identify, quantities of junction boxes, spare conductors, splices, device back boxes, and terminal strips. This submittal shall include a schedule of all connections/terminations, indexed by junction box, device back box, and terminal strip, and shall reference wire tag numbers as installed. The schedule of connections shall show all conductor numbers, color codes, conduit numbers, junction box numbers, and terminations required elsewhere in these specifications.

F. Provide two (2) sets of ½-size drawings to post in the fire control room. The drawings shall show only building background drawings, fire alarm devices, and major system panels and equipment.

G. It is intended that the Owner receive complete and accurate record drawings.

1.12 TEST RECORD

A. System certification and documentation of system testing required elsewhere in these Specifications shall be submitted to the Owner for review and approval at least 14 days prior to the final acceptance test. At a minimum, the Fire Alarm certification and description form depicted in NFPA 72 – 2002 Edition shall be completed and submitted to the Owner for review.

B. A ULI certificate shall be provided by the equipment supplier prior to final acceptance of the system by the Owner.

1.13 SOFTWARE DOCUMENTATION

A. Documentation of Software Modifications shall include:

1. A complete printout of the system program prior to the change.
2. A complete printout of the system program subsequent to the change, with all modifications highlighted.
3. A letter prepared and signed by the individual who made the changes, describing each change made and the reason for that change. This letter shall certify that the preparer has personally reviewed and compared the before and after program printout and verified the correctness of the modification(s).

B. The Contractor, in a binder arranged in chronological order, shall maintain a copy of all software documentation required by this section on-site. This binder shall be turned over to the Owner at the completion of the project.

C. Once the fire alarm system is put into service, in whole or in part, and the associated building(s) partially or wholly occupied, no software changes shall be performed without the prior written permission of the Owner.

D. All software changes to the fire alarm system, once it is in service, shall be performed by a certified manufacturer's representative trained in the execution of such changes. A complete printout of the system program changes shall be provided and submitted with the Operation and Maintenance Manual.

E. A unique version number and date shall identify each revision to the software.

F. The Contractor shall maintain a copy of the program changes in electronic format at the job site and shall include all passwords/codes to access the program. Acceptable storage media shall be floppy disk or electronic media (USB drive).

G. A copy of the final system program shall be provided to the Owner on a CD at the completion of the project.

1.14 WARRANTY

A. The Contractor shall warrant all materials (new and reused) and workmanship during the installation period and for a period of one year beginning with the date of final acceptance by the Owner.

B. During the warranty period the Contractor shall test and certify the new system in accordance with the requirements of NFPA 72 –2002 Edition. All devices shall be tested for maintenance at intervals not to exceed those required by NFPA 72 – 2002 Edition with a written report after each test. The warranty period shall include the first annual inspection and test after final acceptance of the system by the owner.

1.15 TRAINING

A. Conduct two (2) training sessions of four (4) hours each to familiarize the Owner's personnel with the features, operation, and maintenance of the new systems. Training sessions shall be scheduled with the Owner at a time mutually agreeable to the Contractor and the Owner, and may be scheduled after normal business hours so as to not disturb the building occupants.

B. The Contractor shall submit a proposed training agenda for the Owner's review within 30 days of authorization to proceed. The final approved training agenda shall be submitted 14 days prior to the final system acceptance test.

C. Agenda:

1. Training shall include all system operational functions needed by building and security personnel. This shall include, but will not be limited to:

a. Alarm acknowledgement.
b. Interpretation of the scheme for identifiers.
c. System reset.
d. Basic troubleshooting.

1.16 SPECIAL TOOLS

A. The Contractor shall supply as a part of the scope of work, two (2) device programming tools.

1.17 FINAL APPROVAL AND ACCEPTANCE

A. Final approval and acceptance of the work per phase will be given by the Owner when:

1. The complete system has been inspected, tested, and approved in writing by the Owner and OSHPD.

2. All required submittals, including system operation and maintenance manuals, contractor Record Drawings, test reports, training, spare parts, special tools, lien waivers, and training have been provided to, reviewed by, and accepted in writing by the Owner.
3. Record of completion document as outlined in NFPA 72 – 2002 Edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product to match existing Campus fire alarm system –

2.2 EQUIPMENT

A. Main Fire Alarm Control Panel:

1. The fire alarm control panel (FACP)– Model XLS.
2. The FACP shall be complete with cabinets, back boxes, power supplies, battery charger, and batteries rated for a minimum of 4 hours standby and 5 minutes of general alarm signal activation in the event of primary power interruption. The FACP shall be connected to a dedicated life safety circuit on emergency power.
3. The FACP system software shall be stored in non-volatile memory. It shall be password-protected and capable of multiple levels of operator access. All system operations described herein shall be a function of the system software. The system shall be fully field-programmable and editable. Only certified factory-trained technicians shall make any changes in fire alarm programming.
4. All system cards and modules shall have Flash memory for downloading the latest module firmware.
5. The FACP shall have built-in capacity for future expansion. As part of this contract, include a minimum of two internal, programmable relays. In addition, provide 25 percent spare capacity for the following:

    a. Power supplies and battery back up.
    b. Each circuit card, for addition of addressable devices.
    c. Each signal circuit, for addition of notification appliance.
    d. Each signal circuit, for addition of strobe appliances.
    e. Additional mounting space in the FACP cabinet.

B. The logging printer shall be UL listed with the system. This printer shall be supervised for: On/Off line, out of paper, paper jam, power off, and connection to the system. The printer shall be a; high speed, 24 dot matrix or inkjet, wide carriage, and capable of using tractor or friction fed paper. The supervised network connection shall be either Style 4 or 7 as required by the local fire department. The printer shall contain diagnostic LED's for ease in maintenance. The model number shall be PAL-1.

C. The remote annunciator shall be a system display. Locate at the building entry as shown on the Drawings.

1. The System Status Display (SSD) shall be a 4-line 40-character display with backlit screen for easy viewing. The module shall be connected to the network allowing it to be placed anywhere on the system. The system display shall have local sounder with system silence control, acknowledgement, and system reset and shall provide local history. The control portion of the annunciator shall be key operated. The module shall be model number SSD/C.

D. An off site dialer shall be provided. The dialer (DACT) shall be mounted externally. The dialer shall be model number Radionics D9412G-B.

E. The programming tool shall program the intelligent devices with usage and device addresses. The unit shall test both the loop wiring for grounds, opens and shorts. Systems not having this ability shall, tests all the above items and provide a written report documenting the testing procedure as required in the submittal section. The system programmer shall print labels for all addressable devices and contain the complete SLC circuit and device numbers. The programmer shall be model number DPU.

2.3 INTELLIGENT INITIATING DEVICES

A. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections on either Style 4 or Style 6 circuits.

B. Alarm initiating devices shall be addressable technology type and compatible with the existing system.

C. Manual Fire Alarm Boxes:

1. Manual fire alarm boxes shall be provided within 5 feet of each exit, within 200 feet of travel and within the horizontal exit pathways. Provide addressable double action manual stations where shown on the drawings, to be flush or surface mounted as required.

D. Smoke Detectors:

1. Area smoke detectors shall be provided where require by code for the protection of sleeping areas, at smoke separation doors, elevator lobbies, within electrical and mechanical equipment rooms, where applicable to be used in lieu of duct smoke detectors for the control of smoke spread and for compliance with the 2007 California Building Code section 716.3.2.1 options 2 – 5 for smoke damper actuation.
2. Where ambient conditions do not support the use of smoke detectors, heat detectors shall be provided. Should the average ambient temperature of an area exceed 100 degrees, addressable heat detectors shall not be used. Where conventional heat detectors are provided, an addressable monitor module shall be used to monitor a zone of conventional style heat detectors. The addressable monitor module shall be located within a conditioned air space.
3. The smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage.

4. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4 inch square electrical outlet box.

E. Duct Smoke Detectors:

1. The duct smoke detector shall consist of an intelligent digital photoelectric detector with a programmable heat detector housed in a weatherproof enclosure together with a sampling tube. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.

F. Heat Detectors:

1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit.

G. Addressable Monitor Modules:

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact.
2. Water-flow and sprinkler valve supervisory devices shall be individually monitored.
3. The fire alarm system shall be responsible for monitoring for alarm, trouble and supervision of each special suppression system control panel.

H. Addressable Control Relays:

1. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive.

I. Notification Appliances

1. The electronic speaker or speaker/strobe as indicated on the drawings shall be single stroke type and have two position volume adjustment. The chime/strobe shall be available with adjustable strobe intensities of 15, 30, 75, and 110 candelas. The appliance shall be red for wall mounted and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.
2. The strobe only appliance as indicated on the drawings shall be a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15/75, 30/75, 75, and 110 candelas. The appliance shall be red for wall mounting and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.
3. An alarm extender panel shall be provided where needed. The power supply shall be a minimum of 6 amps. The power supply shall contain four supervised notification circuits maximum of 3 amps each circuit. The power supply shall contain built-in synchronizing modules for strobes and audible. There shall be a 3 amp filtered auxiliary power limited output. There shall be a minimum of 8 options as to the operations of the inputs and outputs.

4. Occupant notification appliances shall consist of chimes and strobes to be consistent with the existing fire alarm system throughout the hospital.
5. Private mode notification per section 7.4.3 of NFPA-72 (2002 edition) shall be followed for all patient care areas. It is intended that the sound pressure levels of the chimes shall be designed for 10dBA of ambient at the nurse's stations within each patient care area. Public mode notification shall be used for all other areas.
6. Where sleeping rooms are provided, excluding patient rooms, the sound level of the audible notification appliances shall be equal to or greater than 75dBA measured at the pillow of each sleeping room.
7. Separate circuits shall be provided for the audible and visual notification appliances to insure proper synchronization of the audible and visual appliances.
8. Notification appliances shall be manufactured by Wheelock.
9. Remote booster power supplies for notification appliances shall be manufactured by Wheelock.
10. Notification appliance circuits shall be zoned per floor and per smoke zone.

J. Door Hardware: Provide connection to magnetic door holders as shown on drawings. Magnetic door holder shall be semi-flush mounted for each door. Coordinate equipment with door hardware installer.

2.4 AUXILIARY CONTROL CIRCUITS

A. Where auxiliary circuits are control by the fire alarm system, an addressable relay module shall be provided. Where the voltage and amperage of the auxiliary control circuits exceeds 120VAC and 1amp, an interposing relay shall be provided in a separate enclosure.

B. Magnetic door holder power circuits shall be as indicated by door hardware specifications and shall be configured horizontally per floor.

C. The control of fire / smoke dampers shall be reviewed with the mechanical engineer / contractor for control on a per zone basis. It is not required to monitor the status of passive barrier damper positions when an engineered smoke control system meeting the requirements of Section 909 of the California Building Code is not provided. Supplemental monitoring of the position of passive barrier smoke dampers shall be provided by the mechanical contractor at the request of the owner.

D. Damper control shall be coordinated with the shutdown of the associated mechanical unit supplying air to the zone, when the potential for damage to the duct system is created with the closure of the fire smoke dampers.

E. Damper control circuits shall not be installed in the same mechanical raceway as the signaling line circuit for the addressable control relay.

2.5 FIRE ALARM SYSTEM WIRING

A. All wiring shall conform to NEC Article 760 and to the manufacturer's wiring specifications. Minimum sizes shall be as follows:

1. Signal line circuits – # 18AWG solid copper, twisted pair.
2. Notification circuits – # 14 AWG solid copper.

3. Power circuits – #12 AWG solid copper.

B. All fire alarm cabling shall be run in conduit, UON. Minimum conduit size shall be 3/4-inch conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform work in accordance with the requirements of NFPA 70 and NFPA 72.

B. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.

C. The electrical contractor shall be responsible for all special inspector costs not provided by the Owner.

D. The electrical contractor shall provide all necessary conduit, standard electrical boxes, terminal cans and wiring.

E. The electrical contractor shall install all wiring, terminate all devices and assist with all system pre-tests and final acceptance tests.

F. All wiring shall be installed in accordance with manufacturer's recommendations and the regulatory requirements list in Section 1.4. All wire shall be copper.

G. Connect to sprinkler Flow, PIV and OS&Y switches which are specified under Division 21.

H. Provide wiring from each air-handling unit to duct detector for control of HVAC shutdown. Coordinate work with equipment supplier and installer.

I. Provide wiring from fire alarm system to fire/smoke dampers for closing control on air handling unit zone basis.

J. Fire alarm conductor terminations in control panels and annunciator panels shall be made on terminal strips with a separate point for each conductor. All such strips shall be number identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips. Connect clip with nylon cable straps. Set up termination of cabling so that section of the system may be isolated or shorted out for servicing.

K. From Fire Alarm Control Panel provide one 3/4-inch conduit to the main communications rooms for tie-in to central monitoring station.

L. Provide wiring from fire alarm relays for each elevator controller for elevator control. Coordinate locations and final connection to elevator controller with elevator installer.

M. Provide nameplates, device number labeling and cable tags under provisions of Section 260553 – Identification for Electrical Systems.

N. Each fire door/shutter shall have dedicated smoke detector and shall release upon activation of that detector only. Each fire shutter shall be provided with a separate power supply and connected so that the fire shutter is not released when building service is transferred from normal to emergency sources or vice versa, unless under a fire alarm condition.

O. Route wiring continuous between devices without splices.

P. Use nylon one-piece self-insulated crimp-on wire joints for splices.

Q. Install fire alarm wiring in conduit above accessible ceiling spaces, in walls, and exposed wiring locations. Conduit for fire alarm system shall be identified by red coloring.

R. Install insulated throat fittings on conduit stub-outs for cable protection.

S. Fire proof around conduit penetrations through fire rated construction under the provisions of Division 07.

3.2 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. "Fire Alarm System" decal or silk-screened label shall be applied to all junction box covers.

F. All fire alarm devices shall be semi-flush mounted. The edges of electrical boxes of which the appliances and devices are to be mounted to, shall be flush with the wall or ceiling surfaces. Installation of devices and appliances shall conform to the manufacturer's installation instructions.

3.3 CONDUCTORS

A. All fire alarm wiring shall be jacketed and UL listed fire protective signal cabling for fire alarm use without conduits. Install plenum rated fire alarm wiring where required. Install wiring in conduit for risers, in exposed areas, in walls and in inaccessible ceiling spaces. Route wiring away from close proximity with power wiring and electrical equipment capable of generating RF or inductive fields.

B. Each conductor shall be identified as shown on the drawings with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

C. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

D. All wiring shall meet the equipment manufacturer's recommendations for optimum system operations. Shielded cable shall be used where required to minimize interference and noise.

E. All splices shall be made using terminal blocks. Wire nuts or crimp connectors shall not be used.

F. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers. This is limited to wiring with terminal boxes and does not include connections to devices or appliances.

G. A consistent color code for fire alarm system conductors throughout the installation.

H. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

I. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

J. Termination of conductors other than to the appliances or devices shall be made within terminal boxes not junction boxes. Terminal boxes shall be a minimum of 6 inch x 6 inch square. All terminal strips shall be permanently mounted within the enclosure. Wire nuts or crimp splices shall not be acceptable. Terminal strip legends shall be provided on the inside cover of each terminal box. Terminal boxes shall be labeled "FATC" and shall be numerically identified and coordinated with the shop and record drawings.

K. All wiring landed to a terminal strip shall be proper identified with permanent printed labels. Adhesive labels shall not be acceptable. Labels shall be printed using a Brady® labeler. Samples of labels shall be submitted the owner for approval.

3.4 RELAYS AND OTHER DEVICES

A. Relays and other devices to be mounted in auxiliary panels shall be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within sub-panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.5 CERTIFICATE OF COMPLIANCE

A. Complete and submit Certificate to the Project Engineer in accordance with NFPA 72, most current edition adopted by the Authority Having Jurisdiction.

3.6 FIELD QUALITY CONTROL

A. Testing, General:

1. Provide nameplates, device address or circuits on every initiating and notification appliances. Coordinate with the owner for proper labeling materials. Follow the provisions of Section 260553 – Identification for Electrical Systems.
2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
4. The installing contractor shall make instruments, tools and labor required to conduct the system tests available.
5. The following equipment shall be a minimum for conducting the tests:

    a. Ladders and scaffolds as required to access all installed equipment.
    b. Multimeter for reading voltage, current and resistance.
    c. Two way radios and flashlights.
    d. A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.
    e. Decibel meter.

B. Prior to final acceptance testing with the OSHPD and the Salinas County Fire Marshal, the installing contractor shall conduct and document a 100 percent of all devices and functional sequences of operation. Upon successful completion of this pre-test and correction of any known deficiencies, the contractors' shall demonstrate the system to the facility's agent. The facility's agent will coordinate final acceptance testing with the OSHPD IOR and FLSO

C. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the Engineer of Record and the AHJ.

D. The fire alarm equipment supplier shall make a thorough inspection of the complete installed fire alarm systems including all components such as manual stations, thermal detectors, products-of-combustion detectors, sprinkler flow switches, supervisory switches, controls, etc., to insure the following:

1. Complete and functional system.
2. Underwriters Laboratories requirements.
3. Installed in accordance with manufacturer's recommendations.
4. Regulations covering supervision of components are adhered to.

3.7 DOCUMENTATION

A. System documentation shall be supplied to the owner and shall include but not be limited to the following:

1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DWG format for use in a CAD drafting program.
2. Provide the Owner with six (6) complete system operation and maintenance manuals for all systems and components. The NFPA 72 Record of Completion shall be completed and supplied.
3. Provide two (2) copies of the system program on two Compact Disks (CDs).

3.8 TESTING AND GUARANTEE

A. Contractor shall guarantee all wiring and equipment to be free from inherent mechanical and electrical defects for a period of I year from the date of completion.

B. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100 percent tested and approved. Submit prior to request for final payment.

C. Provide instruction to the Owner with regard to proper use and operation of the system

D. Provide the Owner with 2 complete operation and maintenance manuals for all systems and components. The NFPA 72 Record of Completion shall be completed and supplied.

E. Provide a complete set of record as-built drawings, indicating system components and location, wiring, and conduit system, and operation details.

F. Final testing shall be performed in the presence of the State Fire Marshal and the Owner's representative. The final test shall include a complete test of all system devices and functions, and any additional testing requested by the Fire Marshal. The Contractor shall provide all personnel and equipment necessary to accomplish the test.

G. During the warranty period, the installing contractor shall conduct the required annual testing of the fire alarm system as required by NFPA-72. Any discrepancies found shall be repaired under the provisions of the system warranty.

3.9 COMMISSIONING

A. Refer to Section 018100 – General Commissioning and 26 08 00 – Commissioning for Electrical Systems.

3.10 DIVISION OF RESPONSIBILITY

A. The Contractor shall be responsible for obtaining final acceptance of the fire alarm system as required by the authority having jurisdiction.

END OF SECTION 283100

SECTION 312300 - STRUCTURAL EXCAVATION AND FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Available Information: Geotechnical Report entitled “Phase II Geotechnical Investigation Natividad Medical Center Salinas, California”, dated October 1993 by Haro, Kasunich & Associates, Inc. Geotechnical & Coastal Engineers, is available in accordance with “Information Available to Bidders”.

1.2 SUMMARY

A. This Section Includes:

1. Excavation for foundations and pits.
2. Backfilling structural excavations as required.
3. Fill over concrete mat foundations.

B. Related Sections:

1. Division 03 Section "Concrete Formwork" • for formwork for footings.
2. Division 31 Section "Earthwork• " for mass excavation and/or fill for building pad.

1.3 REFERENCES

A. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where cited in this Section.

B. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete for Buildings, 2010.
2. ACI 229R – Controlled Low Strength Materials, 2013.

C. California Department of Transportation’s (Caltrans):

1. CSS - Standard Specifications, 2010.

1.4 SITE CONDITIONS

A. Notify Owner's Representative when site conditions differ from findings of Geotechnical Investigation Report.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: Concrete materials and proportions shall be in accordance with ACI 301 to produce concrete with minimum compressive strength of 2500 psi at 28 days.

B. Structural Fill: CSS Section 26, Class 2 Aggregate Base rock, 3/4" size.

C. Controlled Low Strength Material: Machine mixed, self-compacting, low-strength fill consisting of fine aggregate, cementitious materials, entrained air and water. Mix and mixing shall conform to recommendations of ACI 229 to achieve the following properties:

1. Slump: 8 to 10 inches.
2. Compressive Strength:

    a. For backfill: Minimum 150 psi to maximum 300 psi at 30 days.
    b. For fill beneath footings: Minimum 300 psi at 30 days.

3. Fresh Density: 115 to 145 pounds per cubic.
4. Subsidence: Minimal; a maximum of 1/16" per foot of thickness.

D. Pea Gravel: ASTM C 33, Size No 7.

1. Fill material (over mat foundation): Crushed rock of uniform gradation, 100% passing 3/4 inch sieve.

PART 3 - PART 3 - EXECUTION

3.1 PREPARATION

A. Take measures to prevent surface water from entering excavations.

B. Notify Geotechnical Engineer at least 48 hours prior to commencing and upon completion of excavations.

3.2 EXCAVATION

A. Accurately cut foundation excavations to dimensions and elevations shown on Drawings to tolerances of ACI 301.

B. Where sides are unstable or excavations are not accurately cut, over-excavate to permit placement and removal of formwork.

C. Shore and brace excavations as required to prevent caving and danger to persons and structures. Comply with applicable safety regulations.

D. Prepare bottoms of footing excavations to produce conditions acceptable to Owner's Representative, based on professional opinion of Geotechnical Engineer.

1. The bottoms of excavations shall be firm, undisturbed earth, clean and free from loose material, debris and foreign matter.
2. Remove or recompact disturbed material.
3. Remove soft or unstable material to a depth satisfactory to Geotechnical Engineer.
4. Fill over-depth excavations with concrete, flowable fill, or structural fill compacted to minimum 95% relative compaction.

E. Maintain footing conditions approved by Geotechnical Engineer until concrete work is complete.

1. In periods of wet weather, over-excavate footings and place 2-inches minimum concrete mud-slab as soon as practical after completing excavation.

F. Keep excavations free of water at all times until foundation concrete is cast.

G. Stockpile or remove excavated material from site in accordance with Division 31 Section "Earthwork".

3.3 BACKFILLING

A. Place and compact fill in accordance with Division 31 Section, "Earthwork".

1. Use pea gravel or controlled density material for backfill against sides of footings and pits, where adequate compaction of structural fill cannot be achieved.

B. Backfill footings after formwork is removed. Do not backfill pits until concrete has cured a minimum of 7 days.

3.4 FILL OVER CONCRETE MAT FOUNDATIONS

A. Preparation:

1. Verify piping is securely supported against vertical and lateral displacement.
2. Where area is not enclosed prior to placement of fill, make provision for removal of water.

B. Placement: Fill may be placed to the full specified thickness without compaction.

1. Pipes: Bed pipes in fill up to grade of underside of pipe, taking care not to place material atop pipe. Shovel slice material under and beside the pipe up to the spring line without moving the pipe.

C. Consolidation: Immediately prior to placement of vapor retarder, consolidate surface with a minimum of 3 passes of a vibratory plate. Achieve specified grade to plus 0 inch to minus 1-1/2 inch tolerance.

END OF SECTION 312300