vanguard villas

PERMIT PACKAGE

Black Twig
Lee Summit, Missouri 64081

PROJECT MANUAL

TR,i Project No.: 20-078

Date: September 2, 2021

TR,i
Architects of the Possible℠

DOCUMENT 000101 - PROJECT TITLE PAGE

1.1 PROJECT MANUAL

A. Project:
Vanguard Villas
Black Twig, Lee Summit, MO 64081

B. **Owner**:

Tegethoff Development
P.O. Box 6331
Fishers, IN 46038
Phone: (765) 639.6300
Website: https://tegethoffdevelopment.com/

C. Architect:

Architect Project No. 20-001

TR,i Architects
1790 Brentwood Blvd.
St. Louis, MO 63144
Phone: (314) 395-9750
Website: www.triarchitects.com

D. Structural:

Bob D. Campbell & Co.
4338 Belleview
Kansas City, Missouri 64111
Phone: (816) 531-4144
Website: www.bdc-engrs.com

E. **General Contractor**:

TBD

F. **Civil Engineer**:

SM Engineering
Kansas City, MO 64108
Phone: (785) 341.9747

G. MEP Engineer:

Latimer Sommers and Associates
3639 SW Summerfield Dr., Suite A
Topeka, KS 66614
Phone: (785) 233-3232

H. **Issued:** September 1, 2021

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END OF DOCUMENT 000101

DOCUMENT 000107 – PROJECT TEAM SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. TR,i Architects
2. Responsible for Divisions 01-14, 33 Sections and Appendix 1 except where indicated as prepared by other design professionals of record.

B. Structural Engineer:

1. Bob D. Campbell & Co.
2. Responsible for Divisions 3, 4, 5, & 6.

C. MEP Engineer:

1. Latimer Sommers and Associates
2. Responsible for Divisions 21, 22, 23, 26, 27, & 28

D. All other design professionals are outside of TR,i's contract and will prepare their own contract documents.

END OF DOCUMENT 000107

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

DIVISION 25 – INTEGRATED AUTOMATION

Not Used

DIVISION 26 – ELECTRICAL

DIVISION 27 – COMMUNICATION

DIVISION 28 – FIRE ALARM AND DETECTION SYSTEMS - ADDRESSABLE

Not used

DIVISION 31 – EARTHWORK

SEE CIVIL DRAWINGS

DIVISION 32 – EXTERIOR IMPROVEMENTS

SEE CIVIL & LANDSCAPE DRAWINGS

DIVISION 33 – UTILITIES

SEE CIVIL DRAWINGS

DIVISION 34 – TRANSPORTATION

SEE CIVIL DRAWINGS

APPENDIXES

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DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Vanguard Villas was prepared by CFS Engineers, dated August 25, 2021 is available for viewing at the office of the General Contractor.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 003132

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SECTION 007000 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

General Conditions of the Contract for Construction governing the work shall be AIA Document A-201 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, 2017 Edition. See Section 008100 SUPPLEMENTARY CONDITIONS TO THE GENERAL CONDITIONS for modifications to this document.

If the Contractor wishes to request modifications, they shall be brought to the Architect's attention during bidding. Both the Architect and Owner shall agree to any additional modifications made by the Contractor, if there are not any modifications brought to the Architect's attention during the bidding and awarding process the Architect will operate under the assumption that the General Conditions and Supplementary Conditions as provided in these specifications are acceptable to the Contractor.

END OF SECTION 007000

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SECTION 008100 - SUPPLEMENTARY CONDITIONS TO THE GENERAL CONDITIONS

PART 1 - GENERAL

The Supplementary Conditions modify, change, delete from, or add to the "General Conditions of the Contract for Construction", AIA Document A-201, 2017 Edition. Where any Article of the General Conditions is modified or voided by the Supplementary General Conditions. The unaltered provisions shall remain in effect. Any modifications to these Supplementary Conditions shall be agreed to in writing by both the Architect and the Owner, the Architect shall not acknowledge any changes to these conditions made without his/her knowledge.

AIA Document A201 General Conditions of the Contract for Construction (2017 Edition), is the General Conditions between the Owner and Contractor. A copy of this Document is hereby specifically made a part of the Contract Documents whether bound within or not. Copies of this document are available for purchase from the St. Louis Chapter, American Institute of Architects (AIA), 911 Washington Avenue, Suite 225, St. Louis, Missouri 63101-1203. Copies are also on file at the Architect's Office for review.

PART 2 - SUPPLEMENT TO THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

TABLE OF CONTENTS OF STANDARD ARTICLES AMENDED BY THE SUPPLEMENTARY CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS

1.1. DEFINITIONS

Add the following paragraphs at the end of Subsection 1.1:

"1.1.8 Product: the term "Product" as used in these Contract Documents refers to materials, systems and equipment provided by the Contractor.

1.1.9 Provide: Supply all materials, labor, tools, transportation, supervision, temporary construction, services and pay all insurance, taxes, tariffs and contributions, unless specifically exempted, necessary to furnish and install material or accomplish processes specified, complete, in place, and ready for use intended in accordance with the Contract Documents.

1.1.10 Required, Requirements: Shall be understood to refer to requirements of the Contract Documents, either explicitly stated or necessary to achieve indicated design and performance standards, unless another interpretation is clearly stated.

1.1.11 Shown, Indicated, Noted: Shall be understood to refer to information contained in the Contract Documents, unless another interpretation is clearly state.

1.1.12 Necessary: Shall refer to that which, in the Architect's interpretation, is required for proper execution of the work or performance of the material supplied, unless another interpretation is clearly stated.

1.1.13 Latest Edition: Shall mean the latest published edition of a document, excluding any editions published subsequent to 30 calendar day prior the issue date of the Project Manual."

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following Paragraph 1.2.4

"All work shall conform to the Contract Documents. No change therefore shall be undertaken without prior review by the Architect. When more detailed information is required for performance of the Work or when an interpretation of the Contract

Documents is requested, the Contractor shall submit a written request to the Architect, who shall furnish such information or interpretation in the form of an Architect's Supplemental Instruction or other written or drawn form or drawing. Where only part of the Work is indicated, similar parts shall be considered repetitive. Where any detail is shown and components thereof are fully described shall be deemed to incorporate similar material and construction."

"In the event of conflicts or discrepancies within the Contract Documents, interpretations will be based on the following priorities.

1. *The Agreement.*
2. *Addenda, with those of the most current date taking precedence over previous Addenda, if applicable.*
3. *The Supplemental Conditions.*
4. *The General Conditions.*
5. *Criteria Specification.*
6. *Specifications.*
7. *Drawings.*

In the case of inconsistencies between the Drawings and Specifications, or within either document, the better quality or greater quantity of Work or Materials shall be provided in accordance with the Architect's interpretation.

In the case of inconsistencies within Drawings and Specifications contrary to proper, recognized construction materials and methods or manufacturer's printed instructions, no work shall be performed and such instances shall be brought to the attention of the Architect in such a manner as to cause no delay in the sequence of the work."

Add the following Paragraph 1.2.5

"The arrangement of Specifications and Drawings, and separations implied in such arrangements, are for convenience of reference only, and such separations or arrangements shall not operate to make the Architect an arbiter to establish limits of Work between subcontractors or between the Contractor and Subcontractor."

ARTICLE 2 - OWNER

2.1 DEFINITION

Add the following paragraph 2.1.3.

The term Owner refers to: Tegethoff Development
P.O. Box 6331

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Paragraph 2.2.3 add to the end of paragraph:

"The Contractor shall be responsible for information furnished by the Owner regarding surveys, subsurface investigation reports, soil borings, and other material of a similar nature to the extent that it impacts or effects the Scope of Work indicated in the Contract Documents. The Owner and the Architect do not guarantee the completeness or accuracy of such information, unless specifically noted otherwise. Using this Owner-furnished information as a base only, the Contractor shall verify all existing grades, conditions, and dimensions of existing structures or features to his satisfaction, and shall report any errors or inconsistencies found, in writing, to the Architect according to the provisions of Paragraphs 3.2.1 and 3.2.2. The Contractor shall establish all lines and levels required to properly execute the Work shall bear all costs involved, and shall be responsible for their maintenance and accuracy."

ARTICLE 3 - CONTRACTOR

3.1 GENERAL

Add the following paragraph 3.1.4

"Should specifications fail to particularly describe the materials or goods to be used as required by the Drawings, then it shall be the duty of the Contractor to inquire of the Architect as to what is to be used and to supply it at the Contractor's expense."

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following paragraph 3.3.4:

"Before ordering any material or doing any work, the General Contractor and all his subcontractors shall verify all measurements at the site. No extra charge or compensation will be allowed on account of difference between actual dimension and measurements indicated on the Drawings unless this difference, which may be found, is submitted by the General Contractor for consideration before proceeding with the work."

Add the following paragraph 3.3.5:

"The General Contract shall be responsible for all Construction Staking required to complete all work as detailed on the Plans and Specifications."

Add the following paragraph 3.3.6:

"The removal of water from the excavation of the building and ditches shall be the duty of the General Contractor who shall be responsible for same when directed by the Architect or Owner."

3.4 LABOR AND MATERIALS

Add the following Sub-paragraph 3.4.1.1:

"During the performance of Work, the General Contractor is responsible for provision and maintenance of warning signs, light signal devices, barricades, guard rails, fences and other devices as appropriate located on site which will give proper and understandable warning to all persons of danger of entry onto land, equipment or structure."

The General Contractor shall be responsible for the equipment, connection and operation cost of all temporary utilities including, but not limited to water, electric, heating, sanitary facilities and material protection.

The cost of material and labor for temporary electric will be the responsibility of the General Contractor. The electrical energy charges for the temporary electric shall be the responsibility of the General Contractor.

Charges for special circuits for electrical welders, hoists, man-lifts, elevators and other special power equipment requiring either heavy current or special voltages shall be the General Contractor's responsibility."

Add the following paragraph 3.4.4:

"After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications)."

Add the following paragraph 3.4.5:

"By making requests for substitutions based on Subparagraph 3.4.4 above, the Contractor:

.1 Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.

.2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified.

.3 Certifies that the cost data presented is complete and includes all related costs under this Contract including the Architect's redesign costs, and waves all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects."

3.5 WARRANTY

Add the following paragraph 3.5.1:

"All warranties and guarantees shall be executed by the manufacturer or Contractor as applicable and addressed to the Owner. All warranties and guarantees shall be submitted to the Owner, in writing, upon completion of the Work and prior to the issuance of Final Certificate of Payment."

Add the following paragraph 3.5.2:

"All warranties and guarantees shall become effective on the date established by the Certificate of Substantial Completion or upon completion and acceptance of the work being warranted whichever date is later"

Add the following paragraph 3.5.3:

"Except where otherwise stated in the Specification, the warranty period shall be for 12 months. Any defects developing from faulty workmanship or materials or from negligence within this period, and any damage to their work resulting therefore, shall be made good by the Contractor without cost to the Owner."

Add the following paragraph 3.5.4:

"In addition to the individual guarantees and warranties provided for components of the Work, the Contractor shall provide a general warranty on the entire Work, for a period of 12 months, warranting the quality and performance of the Work in accordance with these stipulations."

3.10 CONTRACTORS CONSTRUCTION SCHEDULES

Revise paragraph 3.10.1 as follows:

*"The Contractor (delete "<u>, promptly</u>" and replace with **"within 14 days")** after being awarded the Contract..."*

Add the following to the end of paragraph 3.10.1:

"The Contractor shall coordinate all portions of the work and shall include all Work by subcontractors in the submittal."

Add the following paragraph 3.10.4:

"The Schedule shall be in graphic form and shall show start and end dates of all major construction operations, inter-operational dependencies, dollar value and percentage to be completed each month, project meetings and milestones, and submittal schedules,

including date of submittal, date required to be returned after review, and date of supply or fabrication ordering. The Schedule shall be updated monthly showing actual progress against anticipated progress; this updated schedule shall be submitted with each Application for Payment."

Add the following paragraph 3.10.5:

"Failure of the Contractor to comply with requirements of 3.10.1 and 3.10.4 will cause refusal of Contractor's request for payment, until the Contractor complies with said requirements."

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Subparagraph 3.12.7 - Revised to read:

"The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed by the Architect. If the contractor does perform before-referenced work it shall be at their own risk and the Architect shall have the right to request correction of unacceptable work by the contractor at no additional costs to the owner"

Subparagraph 3.12.8 - Revised to read:

"The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's review thereof."

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

Paragraph 4.1.1 - Add the following subparagraph 4.1.1.1:

"The term "Architect" refers to: TR,i Architects
1790 Brentwood Blvd.
St. Louis, MO 63144
Phone: (314) 395-9750

whose name appears on the Drawings and Specifications and who, by Contract with the Owner, is authorized to prepare all pertinent Contract Documents."

4.2 ARCHITECTS ADMINISTRATION OF THE CONTRACT

Paragraph 4.2.7 - The first Line revised to read:

"The Architect will review (delete "and approve,") or take other appropriate action..."

Paragraph 4.2.7 - The last sentence revised to read:

"The Architect's review of a specific item shall not indicate approval of an assembly of which the item is a component."

Subparagraph 4.2.9 - Revised to read:

"The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8;, will request the Contractor to assemble and forward to the Owner for the Owner's review and records written warranties, as-built drawings and related documents required by the Contract, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents."

ARTICLE 5 - SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK.

Paragraph 5.2.1 – Revise the first sentence to read:

"Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, (delete "as soon as practicable" and replace with ***"within 14 days")*** *after award of the Contract (insert* ***",or prior to the first Application and Certificate for Payment, whichever is earlier****,"), shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work."*

ARTICLE 7 - CHANGES IN THE WORK

7.2 CHANGE ORDERS

Add the following paragraph 7.2.2:

"The Contractor will provide a reasonable but "Not to Exceed" price. In order to facilitate checking of quotations for extras or credits, all proposals except those so minor that their propriety can be seen by inspection, shall be accompanies by a complete itemization of costs including labor, materials, and subcontracts. Labor and materials, and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also. Under no

circumstances will work proceed without written authorization from the Owner. After the Work is authorized with all back-up material to support his final price. The back-up material will include, but not be invoices, etc. In no case will the Owner pay in excess of the "Not to Exceed" price.

If the work is such that a "Not to Exceed" price cannot be determined, the work can proceed on a Time and Material basis if authorized in advance, in writing, by the Owner."

Add the following paragraph 7.2.3:

"There shall not be any additional cost for supervision and field office personnel as long as the Work requested by the Change Order is performed during the Contract Construction Periods and the contractor's or Subcontractors' supervisors and workers are presently working on the Project."

ARTICLE 8 - TIME

8.1 DEFINITIONS

Paragraph 8.1.2: Delete this paragraph in its entirety and replace with the following:

"The date of commencement of the Work is the date established in the Contract issued by the Owner".

Paragraph 8.1.3: Delete completely and replace with the following:

"The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the Architect when construction is 100% complete and in all aspects of the work as indicated in the Contract Drawings and Specifications with the exception of Punch List items and as outlined in Section 9.8"

8.3 DELAYS AND EXTENSIONS OF TIME

Paragraph 8.3.2 Add to end of paragraph:

"Requests for extensions of time due to adverse weather conditions shall be submitted promptly with the next monthly Progress Schedule as required in Paragraph 3.10. Requests for extensions of time shall include U. S. Weather Bureau climatologically reports for the months involved and the National Oceanic and Atmospheric Association (NOAA) report indicating the average monthly precipitation, temperature, and other relevant factors for the previous 3 years from the nearest weather reporting station. The 3-year average shall determine the number of days with adverse weather equal to or in excess of 0.5" of rainfall per day. Days of rainfall less than 0.5" shall not be considered. Evaluation of extra day requests shall be considered as they affect the project during stages of construction and days of the Work."

Add the following paragraph 8.3.4:

"The Contractor will have 15 days after the Date of Substantial completion to finish all Punch List items."

Add the following paragraph 8.3.5:

"The Contractor will have 45 days after the Date of Substantial Completion to submit all the Close Out Documents required and Application for Final Payments."

Add the following Paragraph 8.3.5:

"The Contractor shall employ any and all hot and cold weather practices necessary to continue construction of the project in a timely manner and per the contract Schedule. Therefore, requests for extension of time due to periods of high or low temperatures sporadic in nature will not be considered. However, if extended periods of extreme temperatures occur, requests for extension will be considered on a case-by-case bases."

ARTICLE 9 PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

Paragraph 9.3.1 add the following to the end of the paragraph:

"Until the Work is 100% complete, the Owner will pay 90% of the amount due the Contractor on account of progress payments."

Paragraph 9.3.1.1 revise to read:

"Such applications may not include:
Changes in the work that have not been properly authorized by executed Change Orders, including outstanding Construction Change Directives. The Architect may approve partial amounts related to Construction Change Directives only with the written approval from the Owner, prior to the formal Change Order being executed."

Add the following paragraph 9.3.4:

"Each monthly request for payment shall be accompanied by waivers of lien covering the full amount paid by the Owner to the contractor the immediate previous month, and in no case shall more than 30 days elapse between receipt of payment form the Owner and submission of waivers of lien. Such waivers shall be submitted by the Contractor and each Subcontractor to the extent involved."

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following subparagraph 10.1.1:

"When use or storage of explosives or other hazardous materials or equipment or unusual methods is necessary, the Contractor shall give the Owner reasonable advance notice."

ARTICLE 11 - INSURANCE

11.1 CONTRACTOR'S LIABILITY INSURANCE

Add the following paragraph 11.1.0

"The Contractor shall carry any and all Liability Insurances required by Law and insurances as outlined in the agreement between the Owner and Contractor."

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

Paragraph 12.2.2 - Revise to read:

"If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial Completion by period of time between Substantial Completion and the actual performance of the Work. This obligation under this Subparagraph 12.2.2 shall survive acceptance of the Work under Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition."

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Add paragraph 13.1.2:

"The Owner shall rely upon the Contractor to execute the Work in a safe and proper manner. All Work executed as a part of this Contract, and all material used or installed as a part of this Work, shall conform to the provisions of the current edition of OSHA Standards, current OSHA directives, and all other applicable or specified codes and standards governing the Contractor's trade."

13.3 WRITTEN NOTICE

Add the following to paragraph 13.3:

"All notices and communications shall be in writing and shall be deemed given if delivered in accordance with the provisions of the Paragraph to the following addresses:

If to the Owner: Tegethoff Development
P.O. Box 6331
Fishers, IN 46038

If to the Architects: TR,i Architects
1790 Brentwood Blvd.
St. Louis, MO 63144"

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 TERMINATION BY THE OWNER FOR CAUSE

Subsection 14.2.1 - Add paragraph .5

"...stops, delays or interferes with by labor disputes, including strikes, slowdowns, picketing, hand billing or similar interruptions or disturbances (including situations where its work or any Work on the project is stopped, delayed, or interfered with solely as a result of a labor dispute involving others and not in any manner involving Contractor), the work or any portion thereof."

Subsection 14.2.2 - Add paragraph 14.2.4:

"The Contractor shall, as a condition of receiving any payments referred to in Article 14.2 of the General Conditions of the Contract, execute and deliver all such papers and take all such steps, including the legal assignment of their contractual rights, as the Owner may require for the purpose of fully vesting in himself the right and benefits of the Contractor under such obligation or commitment."

Subsection 14.2.2 - Add paragraph 14.2.2.5:

"Any provisions of the General Conditions of the Contract of Construction, Standard Form of Agreement Between Owner and Contractor or other Contract Documents providing for or dealing with the determination of disputes through arbitration or the determination of disputes or certification of sufficient cause by the Architect shall not apply if the Owner exercises its right to terminate the contractor pursuant to Article 14.2 or any other provision of the Contract."

END OF 008100

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 PROJECT INFORMATION

A. Project Identification: Vanguard Villas

1. Project Location: Black Twig at Lowenstein Dr. Lee Summit, MO

B. Owner: Tegethoff Development

1. Owner's Representative:

Lindsey King
Phone: (765) 639.6300
Email: lindsey@tegethoffdevelopment.com

C. Architect: TR,i Architects.

1. Architect's Representative:

Jeff Kaiser
Phone: (314) 395-9750
Email:

D. General Contractor: Brinkmann Constructors has been engaged as Contractor for this Project.

1. General Contractor's Representative:

Scott Grause
Phone: (913) 717-9007
Email: sgrause@brinkmannconstructors.com

1.3 WORK COVERED BY CONTRACT DOCUMENTS

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

1. The project shall consist of 18 two story townhouses. There will be three buildings that are type 5A construction consisting of both wood. Each townhouse is separated by a 2 hour common wall. The first building is a group of 6 townhouses, the second building is a group of 8 townhouses and the third building is a group of 4 townhouses.

B. Type of Contract:

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

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in one phase, with each phase substantially complete as indicated.

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.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 ACCESS TO SITE

A. General: Each Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. 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.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

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. 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 (2) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

C. Restricted Substances: Use of tobacco products and other controlled substances within the existing buildings and on the Construction site is not permitted.

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.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.6 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.8 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. <**Insert number**>: [**Lump-Sum**] [**Unit-Cost**] [**Quantity**] [**Contingency**] [**Testing and Inspecting**] Allowance: Include the sum of <**Insert dollar or quantity amount of allowance**>: Include <**Insert allowance description**> as specified in Section <**Insert Section number**> "<**Insert Section title**>"[**and as shown on Drawings**].

1. This allowance includes material cost, receiving, handling, and installation and Contractor overhead and profit.
2. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. **<Insert unit-price number>** - **<Insert unit-price item>**:

1. Description: **<Insert unit-price item description>** according to Section **<Insert Section number>** "**<Insert Section title>**."
2. Unit of Measurement: **<Insert unit of measurement>**.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 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 the 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 alternates into the Work. No other adjustments are made to the Contract Sum.

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

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections 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. N/A

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 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.

1.3 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. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of 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 substitutions 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 as well as 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 or other approved applicable code organization.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions 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 proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) 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.

1.4 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.

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen **(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.

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

C. Substitutions for Convenience: Architect will consider requests for substitution if received within sixty (60) days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with 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 (7) days before the date scheduled for submittal of initial Applications for 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. Arrange schedule of values consistent with format of AIA Document G703.
2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five (5) percent of the Contract Sum.
3. 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.

4. 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.
5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five (5) percent of the Contract Sum and subcontract amount.

8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

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

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.

C. Payment Application Times: Submit Application for Payment to Architect by the 5th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect.

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

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will 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.

F. Transmittal: Submit a signed and notarized electronic copy (PDF) of each Application for Payment to Architect by email. Include waivers of lien and similar attachments if required.

1. Transmit each Application for Payment with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. 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. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

I. 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 Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. 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.
5. AIA Document G706A.

6. AIA Document G707.
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. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

1.5 GENERAL COORDINATION PROCEDURES

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. 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.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled 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.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed

resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

C. 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 PDF format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
4. 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 Autodesk Revit version 2019 or a mutually agreed version including or beyond version 2019.
    c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.7 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

C. RFI Forms: AIA Document G716 or a software-generated form with substantially the same content as indicated above.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. 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.

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

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include log or software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. 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 (7) days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and/or CAD drawings may be provided by Architect at the Architect’s discretion for Contractor's use during construction.

1. Digital data files may be used by the Contractor in preparing Project record Drawings.
2. Digital data files may not be used by the Contractor in preparing coordination drawings and Shop Drawings.
3. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
4. Digital Drawing Software Program: Contract Drawings are available in Autodesk Revit version 2019 or a mutually agreed version including or beyond version 2019.
5. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.

    a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall each execute a separate data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.

6. The following digital data files will be furnished for each appropriate discipline:

    a. Floor plans.
    b. Reflected ceiling plans.
    c. Exterior building elevations.

B. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project software site includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.
    h. Processing and tracking of contract modifications.
    i. Creating and distributing meeting minutes.
    j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    k. Management of construction progress photographs.
    l. Mobile device compatibility, including smartphones and tablets.

2. Provide web-based Project software user licenses for use of Owner, Architect, and Architect's consultants. If necessary, provide software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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 submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

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

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement.

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. 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. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Sustainable design requirements.
    o. Preparation of Record Documents.
    p. Use of the premises and existing building.
    q. Work restrictions.
    r. Working hours.
    s. Owner's occupancy requirements.
    t. Responsibility for temporary facilities and controls.
    u. Procedures for moisture and mold control.
    v. Procedures for disruptions and shutdowns.
    w. Construction waste management and recycling.
    x. Parking availability.
    y. Office, work, and storage areas.
    z. Equipment deliveries and priorities.
    aa. First aid.

bb. Security.
cc. Progress cleaning.

3. Minutes: Provide recording and distribution of meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

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

D. Progress Meetings: Conduct progress meetings at monthly or as mutually agreed appropriate interval.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner**,** and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
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) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Status of sustainable design documentation.
        6) Deliveries.
        7) Off-site fabrication.
        8) Access.
        9) Site use.
        10) Temporary facilities and controls.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) Status of 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. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's/Engineer's responsive action.

B. Informational Submittals: Written information that does not require Architect's/Engineer's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect/Engineer for Contractor's use in preparing submittals.

B. 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. 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/Engineer reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's/Engineer's receipt of submittal.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect/Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow twenty (21) days for initial review of each submittal.
3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow 15 days for processing each resubmittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4-inches by 5-inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect/Engineer.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect/Engineer.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect/Engineer observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect/Engineer.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect/Engineer will return submittals, without review, received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect/Engineer on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Provide locations on form for the following information:

    a. Project name.
    b. Date.
    c. Destination (To:).
    d. Source (From:).
    e. Names of subcontractor, manufacturer, and supplier.
    f. Category and type of submittal.
    g. Submittal purpose and description.
    h. Submittal and transmittal distribution record.
    i. Remarks.
    j. Signature of transmitter.

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

I. Use for Construction: Use only final submittals with mark indicating action taken by Architect/Engineer in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:

    a. Initial Submittal: Submit a preliminary electronic (PDF) copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.
    b. Final Submittal: Submit only electronic (PDF) copies. Architect will retain an electronic (PDF) copy.

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 printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operating and maintenance manuals.
    k. Compliance with recognized trade association standards.
    l. Compliance with recognized testing agency standards.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shop work manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2-inches by 11-inches but no larger than 30-inches by 42-inches.
4. Number of Copies: Submit copies of each submittal, as follows:

    a. Initial Submittal: Submit an electronic (PDF) copy. Architect will return the electronic (PDF) copy.
    b. Final Submittal: Submit an electronic (PDF) copy. Architect will return the electronic (PDF) copy.

D. Samples: Prepare physical units of materials or products, including the following:

1. 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.
2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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.
3. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

    a. Generic description of Sample.
    b. Product name or name of manufacturer.
    c. Sample source.

4. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

    a. Size limitations.
    b. Compliance with recognized standards.
    c. Availability.
    d. Delivery time.

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

    a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of the variations.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

6. Number of Samples for Initial Selection: Submit two (2) full set 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.
7. Number of Samples for Verification: Submit 1 Sample. Architect will retain 1 Sample set; remainder will be returned.

a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

8. 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.

E. Product Schedule or List: 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.
2. Number and name of room or space.
3. Location within room or space.

F. Submittals Schedule:

G. Application for Payment:

H. Schedule of Values:

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.

3. Test and Inspection Reports:

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

C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

I. Preconstruction Test Reports: Prepare 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.

J. Compatibility Test Reports: Prepare 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.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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.

M. Research/Evaluation Reports: Prepare 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.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures Operation and Maintenance Data."

O. Design Data: Prepare 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.

P. 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.

Q. 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. 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 ACTION

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

B. Submittal will only be reviewed for conformance with information and design concepts expressed in the contract documents. Review does not cover and contractor remains responsible for: quantities, accuracy, dimensions, fit, installation, performance or equipment or systems, coordination with other trades, etc., as outlined in AIA documant A201, General Conditions of Contract for Construction, 2017 Edition. Review does not authorize any changes in the contract requirements unless stated in an approved change order.

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

1. Final Unrestricted Release: When the Architect marks a submittal "Received," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Architect marks a submittal "Reviewed as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Architect marks a submittal " Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

    a. Do not use, or allow others to use, submittals marked "Revise and Resubmit” at the Project Site or elsewhere where Work is in progress.

D. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

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

F. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

SUBMITTAL COVER SHEET

PROJECT NAME: VANGUARD VILLAS

ARCHITECT: TR,i ARCHITECTS

SPECIFICATION SECTION: _____

DATE PREPARED: _____

CONTRACTOR: _____

SUBCONTRACTOR'S NAME: _____

SUBCONTRACTOR'S PHONE: _____

MANUFACTURER'S NAME: _____

MANUFACTURER'S PHONE: _____

ITEM: _____ **NUMBER OF PAGES:** _____

ARCHITECT'S STAMP	**CONTRACTOR'S STAMP**

END OF SECTION

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

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. 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.
2. 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. See Divisions 2 through 33 Sections for specific test and inspection requirements.

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

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

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

G. 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.

H. 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.

1.3 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.

1.4 SUBMITTALS

A. 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.

B. 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.

C. 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.

1.5 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. 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.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as

documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. 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.

I. Mockups: 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 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.
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.

1.6 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 1 Section "Submittal Procedures."

D. 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.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

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.

1.7 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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 Division 1 Section "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

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 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 by Architect 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. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design 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 seven (7) days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

    a. Form of Architect's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 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.

1.5 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. 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. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 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 other Sections for specific content requirements and particular requirements for submitting special warranties.

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. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.

    a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.

a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"

7. 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.

   a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

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 Section 012500 "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 of Comparable Products: 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 proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
4. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 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.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by a land surveyor certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit two (2) copies signed by the land surveyor.

D. Final Property Survey: Submit two (2) copies showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. 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.
3. 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.
4. 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.

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.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

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. 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 local utility, civil engineer and Owner that it 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

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 land surveyor 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.

C. Benchmarks: Establish and maintain a minimum of two (2) 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.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

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.

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: Where possible, select tools or equipment that minimize production of excessive 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 portions of the 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. Remove and replace damaged, defective, or non-conforming Work.

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 or minimize 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 and Masonry: 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. 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.
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.
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.

I. 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. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. 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.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

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.

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: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with all applicable legal off-site waste disposal requirements and per section 017419 “Construction Waste Management and Disposal.”

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.

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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components.

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: 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

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

1. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
2. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal of construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

C. Recycle: Recovery of construction waste for subsequent processing in preparation for reuse.

1.3 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within thirty (30) days of date established for commencement of the Work.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS (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.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. 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 (3) 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.

D. 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 and recycled.
2. Control dust and dirt, environmental protection, and noise control.

3.2 RECYCLING 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 accrue to 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 as often as required to prevent overfilling bins.

3.3 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.

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.

D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

D. 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.

3.5 ATTACHMENTS

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. See Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

C. See Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

D. See Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 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, damage or settlement surveys, property surveys, 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 of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 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 1 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 pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

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 of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 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.

1.5 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. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual and submit electronic (PDF) copies.

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.

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 an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations 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, 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 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 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.
r. Leave Project clean and ready for occupancy.

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.

END OF SECTION 017700

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Emergency manuals.
2. Operation manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. See Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit an electronic (PDF) copy of manual in final form at least 15 days before final inspection. Architect will return comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit electronic (PDF) copies of the corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 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 a title page, table of contents, and manual contents.

B. Title Page: 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.

C. 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.

D. 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 file.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and 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 for fire, flood, gas leak, water leak, power failure, water outage, and equipment failure.

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 instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

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 start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

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.

2.4 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 inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and 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.

2.5 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 maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:

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.

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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. 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.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. 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.

D. 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.

E. 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.

END OF SECTION 017820

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. See Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

C. See Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Copies: Submit electronic (PDF) copies of Record Drawings.

B. Record Specifications: Submit electronic (PDF) copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit electronic (PDF) copies of each Product Data submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

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 prepare the 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. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Include identification on cover sheets.

2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

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. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

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, Record Specifications, and Record Drawings where applicable.

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. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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 modifications to Project Record Documents as they occur; do not wait until the 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 reference during normal working hours.

END OF SECTION 017839

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 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.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 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 have been reviewed and approved by Architect.

1.6 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. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.

f. Identification systems.
g. Warranties and bonds.
h. 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.

1.7 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.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. 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 (7) days' advance notice.

D. 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.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and a demonstration performance-based test.

F. 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.

1.9 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. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of twelve (12) megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings on thumb drive or by uploading to web-based Project software site.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1.	ACI 211.1	Recommended Practice for Selecting Propositions for Concrete
2.	ACI 214 Results	Recommended Practice for Evaluation of Compressive Test for Field Concrete
3.	ACI 301	Structural Concrete of Buildings
4.	ACI 304 Concrete	Recommended practice for Measuring, Mixing and Placing
5.	ACI 305	Recommended Practice for Hot Weather Concreting
6.	ACI 306	Recommended Practice for Cold Weather Concreting
7.	ACI 309	Recommended practice for Consolidation of Concrete
8.	ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures
9.	ACI 318	Building Code Requirements for Reinforced Concrete
10.	ACI 347	Recommended Practice for Concrete Framework

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II.
2. Fly Ash: ASTM C618, Class C.

B. Normal-Weight Aggregates: ASTM C33/C33M, graded.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water: ASTM C94/C94M and potable.

2.5 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Sika/Greenstreak PVC Waterstop or equal by BoMetals or Vinylex Waterstop & Accessories.
      a. Profile: Ribbed with center bulb
      b. Dimensions: 6 inches by 1/8 inch to 3/16 inches thick; tapered
   2. Self-Expanding Butyl Strip Waterstop: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete
      a. CETCO Waterstop RX 101 or approved equal
      b. 3/4 by 1 inch
   3. Base Seals Flexible PVC: For embedding into concrete walls at control joints on exterior faces of below greade walls, affixed to forms per manufacturers recommendations
      a. Greenstreak/Sika #7772 or BoMetals, Inc. #BS-9316

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: 15 mil, ASTM E1745, Class A Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, non-extruding, resilient, bituminous type.

A. Curing Compounds/Densifier/Hardner – For Dock, Trash Room, Pool Equipment Room, Resident Storage and Bike Storage Areas:

1. Sonneborn - "Lapidolith"
2. Ashford Formula, by Curecrete, or equal.

B. Curing Compounds - One of the following for remaining areas:

1. Sonneborn – “Kure-n-Seal WB” or equal.
2. Wet cure w/ blankets.

C. Perimeter foundation insulation shall be as indicated, 2” thick by 24” high Styrofoam brand square edge as manufactured by Dow Chemical Company or approved equal.

D. Base under interior concrete slabs shall be a minimum of 6" thick (unless otherwise required by Structural or Geotechnical Engineer) base of 1/2" to 3/4" clean free draining crushed limestone over unless otherwise noted.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 15 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture for footings and grade beams as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

B. Proportion normal-weight concrete mixture for piers as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 6 inches (100 mm), for concrete with verified slump of 4 to 6 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
4. Air Content: 3 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

C. Proportion normal-weight concrete mixture for interior flatwork and foundation walls as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.46.
3. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Submit test data proving concrete design mix shrinkage is less than 0.034% at 28 days when tested according to ASTM C157 (air drying method only).

D. Proportion normal-weight concrete mixture for exterior flatwork as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.42.
3. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 WATERSTOP INSTALLATION

A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or

adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure four standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two laboratory cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment,

compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

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SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU's).

B. Related Sections:

1. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
2. Section 076200 "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties and material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding and other special conditions.
   2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
   2. Density Classification: Lightweight unless otherwise indicated.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide concrete and masonry lintels as indicated on Drawings, comply with requirements below

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide custom color as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91.

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. Capital Materials Corporation; Flamingo Color Masonry Cement.
   b. Holcim (US) Inc.; [Mortamix Masonry Cement] .
   c. Lafarge North America Inc.; [Magnolia Masonry Cement] [Lafarge Masonry Cement].
   d. Lehigh Cement Company; [Lehigh Masonry Cement] .
   e. National Cement Company, Inc.; Coosa Masonry Cement.

E. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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. Euclid Chemical Company (The); Accelguard 80.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
   c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: [Hot-dip] galvanized, carbon steel.
2. Exterior Walls: [Hot-dip galvanized, carbon] steel.
3. Wire Size for Side Rods: [0.187-inch (4.76-mm)] diameter.
4. Wire Size for Cross Rods: [0.187-inch (4.76-mm)] diameter.
5. Wire Size for Veneer Ties: [0.187-inch (4.76-mm)] diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m)[, with prefabricated corner and tee units].

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus [2 side rods] at each wythe of masonry 4 inches (100 mm) wide or less.
2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.[Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.]

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, [hot-dip galvanized, carbon] [stainless]-steel continuous wire.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Wire: Fabricate from 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from [0.25-inch- (6.35-mm-)] diameter, hot-dip galvanized steel wire.

E. Partition Top anchors: 0.105-inch- (2.66-mm-) thick metal plate with 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: [Hot-dip galvanized to comply with ASTM A 153/A 153M].

G. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2.7 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use[one of] the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) DuPont; Thru-Wall Flashing.
2) Hohmann & Barnard, Inc.; Flex-Flash.
3) Hyload, Inc.; Hyload Cloaked Flashing System.
4) Mortar Net USA, Ltd.; Total Flash.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from [neoprene] [urethane] [or] [PVC].

B. Preformed Control-Joint Gaskets: Made from [styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805] [or] [PVC, complying with ASTM D 2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use[one of] the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Blok-Lok Limited; Cell-Vent.
3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
4) Heckmann Building Products Inc.; No. 85 Cell Vent.
5) Hohmann & Barnard, Inc.; Quadro-Vent.
6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Advanced Building Products Inc.; [Mortar Break] [Mortar Break II].
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.-

2. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep.
b. Strips, not less than [1-1/2 inches (38 mm)] thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.

2.9 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product

expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

   a. Diedrich Technologies, Inc.
   b. EaCo Chem, Inc.
   c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use [portland cement-lime] [or] [masonry cement] mortar unless otherwise indicated.
3. For exterior masonry, use [portland cement-lime] [or] [masonry cement] mortar.
4. For reinforced masonry, use [portland cement-lime] [or] [masonry cement] mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, [Proportion] Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use [Type S].
2. For reinforced masonry, use Type N.
3. For mortar parge coats, use [Type S] [or] [Type N].
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, specified 28-day compressive strength of 3000 psi.

3. Provide grout with a slump of 5 to 9 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed [16 inches (406 mm)] o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] .
    b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement[with continuous horizontal wire in facing wythe attached to ties].
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement[with continuous horizontal wire in facing wythe attached to ties] to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.

D. Coat cavity face of backup wythe to comply with Section 071113 "Bituminous Dampproofing."

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings[in addition to continuous reinforcement].

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to [wall framing] [and] [concrete and masonry backup] with[seismic] masonry-veneer anchors to comply with the following requirements:

1. Fasten [screw-attached] [and] [seismic] anchors [through sheathing to wall framing] [and] [to concrete and masonry backup] with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed [connector sections and continuous wire] in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and [24 inches (610 mm)] o.c. horizontally with not less than 1 anchor for each [2.67 sq. ft. (0.25 sq. m)] of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
1. Build flanges of factory-fabricated, expansion-joint units into masonry.
2. Build in compressible joint fillers where indicated.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.[Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.]

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use [specified weep/vent products] to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use [specified weep/vent products] to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm).

B. Use a steel-trowel finish to produce a smooth, flat, dense surface. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 73 00 - MANUFACTURED MASONRY VENEER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Portland cement based manufactured stone veneer and trim.

1.02 SUBMITTALS

A. Reference Section 01 33 00-Submittal Procedures; submit following items:

1. Product Data.
2. Samples:
    a. Standard sample board consisting of small-scale pieces of veneer units showing full range of textures and colors.
3. Quality Assurance/Control Submittals:
    a. Qualifications:
        1) Proof of manufacturer qualifications.
        2) Proof of installer qualifications.
    b. Regulatory Requirements: Evaluation reports.
    c. Veneer manufacturer’s installation instructions.
    d. Installation instructions for other materials.

B. Closeout Submittals: Reference Section 01 77 70-Closeout Procedures; submit following items:

1. Maintenance Instructions.
2. Special Warranties.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Eldorado Stone, LLC.
2. Installer Qualifications: Experienced mason familiar with installation procedures and related local, state and federal codes masonry.

B. Field Sample:

1. Prepare 4 by 4 foot sample at a location on the structure as selected by the Architect. Use approved selection sample materials and colors.
2. Obtain Architect’s approval.
3. Protect and retain sample as a basis for approval of completed manufactured stone work. Approved sample may be incorporated into completed work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Reference Section 01 60 00-Product Requirements.

B. Follow manufacturer’s instructions.

1.05 PROJECT/SITE CONDITIONS

A. Environmental Requirements: When air temperature is 40 degrees F (4.5 degrees C) or below, consult local building code for Cold-Weather Construction requirements.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard warranty coverage against defects in materials when installed in accordance with manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Eldorado Stone, LLC
1370 Grand Ave., Bldg. B
San Marcos, CA 92069
Tel: (800) 925-1491
Fax: (760) 736-3840
E-Mail: customerservice@eldoradostone.com
Website: www.eldoradostone.com

1. Manufacturer's Distributor: Midwest Brick and Block

B. Substitutions: None Allowed.

2.02 MATERIALS

A. Stone Veneer:

1. Profile: Ledgecut , Color: Birch. Include matching corner pieces.

B. Veneer Unit properties: Precast veneer units consisting of portland cement, lightweight aggregates, and mineral oxide pigments.

1. Compressive Strength: ASTM C 192 and ASTM C 39, 5 sample average: greater than 1,800 psi (12.4MPa).

2. Shear Bond: ASTM C 482: 50 psi (345kPa), minimum.

3. Freeze-Thaw Test: ASTM C 67: Less than 3 percent weight loss and no disintegration.

4. Thermal Resistance: ASTM C 177: 0.473 at 1.387 inches thick

5. Weight per square foot: 2012 IBC and 2012 IRC, ASTM C1670, 15 pounds, saturated.

C. Two layers of Weather Barrier: See Section 072700 - Fluid Applied Membrane Air Barriers and paper-backed lath, per reinforcing below.

D. Reinforcing: ASTM C 847, 2.5lb/yd2 (1.4kg/m2) paper backed self-furring galvanized expanded metal lath complying with code agency requirements for the type of substrate over which stone veneer is installed. Paper backing shall be Grade D asphalt saturated kraft paper or better.

E. Mortar:

1. Cement: Portland cement complying with ASTM C 1329.

2. Lime: ASTM C 207.

3. Sand: ASTM C 144, natural or manufactured sand.

4. Water: Potable.
5. Pre-Packaged Latex-Portland Cement Mortar: ANSI A118.4.

F. Bonding Agent: Exterior integral bonding agent meeting ASTM C 932

2.03 MORTAR MIXES

A. Jointless/Dry-Stacked Installation:

1. Polymer modified mortar complying with ANSI A118.4
2. Mortar prepared to comply with ASTM C270. Type S mortar.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.02 PREPARATION

A. Protection: Protect adjacent work from contact with mortar.

B. Surface Preparation: Prepare substrate in accordance with manufacturer’s installation instructions for the type of substrate being covered.

3.03 INSTALLATION

A. Install and clean stone in accordance with manufacturer’s installation instructions for Jointless/Dry-Stacked installation as specified above.

3.04 CLEANING

A. Reference Section 01 74 00-Cleaning and Waste Management.

B. Remove protective coverings from adjacent work.

C. Cleaning Veneer Units:

1. Wash with soft bristle brush and water/granulated detergent solution
2. Rinse immediately with clean water

D. Removing Effloresence:

1. Allow veneer to dry thoroughly
2. Scrub with soft bristle brush and clean water
3. Rinse immediately with clean water; allow to dry
4. If efflorescence is still visible, contact ES Customer Service for assistance

END OF SECTION 047300

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Prefabricated building columns and beams.
5. Metal bollards.

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.

PART 2 - PRODUCTS

2.1 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 A36.

C. Stainless Steel Bars and Shapes: ASTM A276, Type 304.

D. Steel Tubing: ASTM A500, cold-formed steel tubing.

E. Steel Pipe: ASTM A53, Standard Weight (Schedule 40) unless otherwise indicated.

F. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

G. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

H. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum and stainless steel.
2. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.3 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi.

2.4 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 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 or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

B. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.6 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.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.8 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. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.10 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.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 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.

1. Shop prime with zinc-rich primer.

C. Preparation for Shop Priming:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 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 screws, 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.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. 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 overhead grilles securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with either expansion anchors, anchor bolts and through bolts, depending on the substrate condition.

D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION OF 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 shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 055000

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all Rough Carpentry Work, complete and in place, as shown on the Drawings and as specified herein.

1.2 MEASUREMENTS

A. Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment of all parts is required. Before starting Work, check all lines and levels indicated and such other Work as has been completed. Should there be any discrepancies, immediately report to Architect.

1.3 COORDINATION

A. Coordinate Work with all other trades (Electrical, Mechanical, Plumbing, etc.) and do all cutting and patching required to accommodate their Work. Protect all adjacent Work.

1.4 DELIVERY AND STORAGE

A. As per GENERAL CONDITIONS, deliver and store lumber on sills and cover for protection. Ensure ventilation and drainage; protect against weather and damage. Keep all materials clearly identified, with all grade marks legible

1.5 WOOD BACKINGS

A. Provide all wood backing, furring, stripping or blocking indicated or required for installation and attachment of Work of all other trades. Cut and frame all openings required by other trades. Structural members shall not be cut, notched or drilled, except as may be shown or noted on Drawings

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rough carpentry materials shall be as follows (unless otherwise noted on the Structural Drawings):

1. Sills & Bottom Plates in contact with concrete shall be 2x4, 2x6, & 2x8, Pressure Preservative Treated DF or SP, Grade as noted on the Drawings.
2. Top Plates and Studs shall be 2x4, 2x6, & 2x8 #2 Grade DF as noted on the Drawings.

3. Headers, Joists & Rafters shall be sizes indicated #2 DF.
4. Special Headers shall be as indicated Laminated Veneer Lumber (LVL), or Parallam Parallel Strand Lumber (PSL).
5. Miscellaneous Studs, Blocking, Etc. shall be 2x4 & 2x6 #3 Df or SP.
6. Floor Sheathing shall be 23/32" thick T&G APA Rated CD grade plywood.
7. Roof Sheathing at Sloped Roof Areas shall be 15/32" thick APA Rated Exterior Grade Sheathing.
8. Roof Sheathing at Flat Roof Areas shall be 19/32" thick APA Rated Exterior Grade Sheathing.
9. Exterior Wall Sheathing shall be 7/16" thick APA Rated OSB wall sheathing.
10. Plywood at the Balcony Floors shall be 15/32" thick pressure treated plywood.
11. Exterior Posts and Beams shall be as indicated Pressure Preservative Treated including all balcony framing material.
12. Rough hardware shall include all nails, bolts, clip angles, plates, etc. required for all rough and exterior finish carpentry. All joist hangers and miscellaneous metal connectors shall be Simpson Strong-Tie, Kant-Sag, EFI or approved equal. Exterior hardware and fasteners and fasteners shall be galvanized.
13. Refer to Structural Drawings for additional information.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Carpentry methods and procedures shall be as follows:

1. Mudsills shall be pressure preservative treated, bolted to foundation wall with sill sealer, as noted on drawings.
2. Roof trusses shall be 24" o.c. maximum, doubled and tripled as indicated or required and have crown at top.
3. Floor trusses shall be 24” o.c. maximum, doubled and tripled as indicated or required and have crown at top.
4. Truss bracing and bridging shall be located as indicated on the plans or as required by truss manufacturer.
5. Stud wall sole plates shall be securely anchored to floor or slab. Double top plates.
6. Exterior studs shall be 16" o.c. maximum; spaced for openings, and doubled at openings, and tripled at corners and as indicated on the Structural drawings.
7. Interior studs shall be 16" o.c. maximum; spaced for doors and ducts; doubled at openings, and tripled at corners and as indicated on the Structural drawings.
8. Provide solid blocking under all headers, beams, doubled trusses, etc. bearing on stud walls.
9. Wind brace all exterior walls as indicated on the drawings.
10. Wood beams shall be set true, plumb, level to provide tight joints at connections over solid, full width blocking at all points of beam bearing.
11. Fire stop all common walls at floor and plate lines.
12. Install roof deck and subfloor with face grain perpendicular to supports. Terminate panels over supports. Stagger end joints of adjacent panels 4'-0".

a. Allow 1/16" between end joints and 1/8" between edge joints for expansion and contraction.
b. Lay glue bead on each joist for glue and nail construction. Install in accordance with manufacturer's product data.
c. Attach sheathing as indicated on the Structural drawings.
d. Install plywood edge clips at all unsupported edges.

13. Position wall sheathing over exterior studs with long dimension vertically and 1/8" between sheets for expansion.
14. Glue and nail subfloor to joists.
15. Fire stop all party walls and chases at floor and plate lines.
16. All wood framing within the same plane shall be connected with Simpson, Kant-Sag or EFI connectors.
17. All exterior walls shall receive one layer of Weather Barrier as specified in DIVISION 7.
18. Space all joists and trusses as required for exact location of recessed light fixtures as indicated, i.e., light fixtures will center over windows, sinks, etc.
19. Roof sheathing shall be installed in strict accordance with the roofing manufacturer's specifications for roof decks.
20. Provide solid blocking as indicated for current of future grab bar installation in all bathrooms and restrooms. Provide solid blocking 2x4 or 2x6 to receive towel bars or toilet paper holders as indicated in all apartment bathrooms. Provide solid blocking at all TV locations indicated for attachment of wall mounted TVs.

END OF SECTION 061000

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SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Composite nail base insulated roof sheathing.
5. Subflooring.
6. Underlayment.
7. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

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.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.

2.5 WALL SHEATHING

A. Plywood Sheathing: Exposure 1 sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

C. Paper-Surfaced Gypsum Sheathing: ASTM C1396, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

1. Type and Thickness: Type X, 5/8 inch thick.

D. Glass-Mat Gypsum Sheathing: ASTM C1177.

1. Type and Thickness: Type X, 5/8 inch thick.

E. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C1278, gypsum sheathing.

1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
2. Type and Thickness: Type X, 5/8 inch thick.

F. Cementitious Backer Units: ASTM C1325, Type A.

1. Thickness: 5/8 inch.

G. Extruded-Polystyrene-Foam Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.

1. Thickness: 1 inch.
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

H. Foil-Faced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type I or Type II, Class 2, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.

1. Thickness: 1 inch.
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.6 ROOF SHEATHING

A. Plywood Sheathing: Exposure 1 sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

2.7 PARAPET SHEATHING

A. Plywood Sheathing: Exposure 1 sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

C. Glass-Mat Gypsum Sheathing: ASTM C1177.

1. Type and Thickness: Type X, 5/8 inch thick.

2.8 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 oriented strand board on one face.

1. Polyisocyanurate-Foam Thickness: As indicated to achieve scheduled R-Value.
2. Oriented-Strand-Board Nominal Thickness: 5/8 inch.

2.9 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Underlayment single-floor panels.

B. Oriented-Strand-Board Combination Subfloor-Underlayment: DOC PS 2, Exposure 1 single-floor panels.

C. Plywood Subflooring: Exposure 1 single-floor panels or sheathing.

D. Oriented-Strand-Board Subflooring: DOC PS 2, Exposure , single-floor panels or sheathing.

E. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
2. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness.
3. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment
4. Particleboard Underlayment: ANSI A208.1, Grade PBU.
5. Hardboard Underlayment: ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.10 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153 or Type 304 stainless steel.

2.11 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.12 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:

    a. Glue and nail to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

2. Subflooring:

    a. Glue and nail to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:

    a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

4. Underlayment:

    a. Nail to subflooring.
    b. Space panels 1/32 inch apart at edges and ends.
    c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.6 PARTICLEBOARD UNDERLAYMENT INSTALLATION

A. Comply with CPA's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.

1. Fastening Method: Glue and nail underlayment to subflooring.

END OF SECTION 061600

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SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

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. Wood roof trusses.
2. Wood floor trusses.
3. Wood girder trusses.

B. Related Requirements:

1. Section 313116 "Termite Control" for site application of borate treatment to wood trusses.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For wood-preservative-treated lumber, fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from 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 from 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, 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 D5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

B. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

C. Evaluation Reports: For the following, from ICC-ES:
1. Metal-plate connectors.
2. Metal truss accessories.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. 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. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads:

    a. Roof Trusses: As indicated
    b. Floor Trusses: As indicated

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with **1**9 percent maximum moisture content at time of dressing.

B. Minimum Specific Gravity for Top Chords: **0.50**

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M

B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable design loads, as published by manufacturer, shall comply with or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by

comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.8 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND 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 wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 061753

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Molded polystyrene foam-plastic board.
3. Glass-fiber blanket.
4. Mineral-wool blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards."

B. Extruded Polystyrene Board, Type X ASTM C578, Type X, 15-psi (104-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.
   1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Extruded Polystyrene Board, Type VII: ASTM C578, Type VII, 60-psi (414-kPa) minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

2.2 MOLDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Molded Polystyrene Board, Type I: ASTM C578, Type I, 10-psi (69-kPa) minimum compressive strength.

2.3 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

B. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

2.4 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. 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 (76-mm) 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction
    b. Interior Walls: Set units with facing placed toward areas of high humidity.

B. 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. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
2. Install insulation to fit snugly without bowing.

END OF SECTION 072100

SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
2. Water-resistive barrier coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive barrier coatings.

B. Shop Drawings:

1. Include details for EIFS buildouts.
2. Include details for parapet cap flashing.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer certificates.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products that comply with the criteria outlined in this specification by one of the following manufacturers:
   1. Dryvit
   2. Sto
   3. Or approved equal

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

   1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
   2. Impact Performance: ASTM E2568, Standard impact resistance unless otherwise indicated.
   3. Drainage Efficiency: 90 percent average minimum when tested according to ASTM E2273.

2.3 EIFS MATERIALS

A. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.

   1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.

B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate.

D. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M.

   1. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.

E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with

retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098/E2098M.

F. Base Coat: EIFS manufacturer's standard mixture.

G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

H. Finish Coat: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance.

1. Colors: As indicated on the drawings
2. Textures: As indicated on the drawings

I. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

B. Water-Resistive Barrier Coating: Apply over sheathing to provide a water-resistive barrier.

C. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

D. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.

E. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397.

1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
2. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.

3. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.

F. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer.

G. Base Coat: Apply full coverage to exposed insulation and foam build-outs with not less than 1/16-inch (1.6-mm) dry-coat thickness.

H. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

I. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

J. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

K. Foam Buildouts: Fully embed reinforcing mesh in base coat.

L. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

M. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

N. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

END OF SECTION 072419

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wrap.
   2. Flexible flashing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

   1. The following manufacturer and product shall be the basis of design. Equal alternates in compliance with the criteria within this specification shall be considered when submitted in writing to the Architect:
      a. DuPont, Tyvek Commercial Wrap D
   2. Water-Vapor Permeance: Not less than 30 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
   3. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.8 mm)

1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.8 mm)
   1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

   1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

   1. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
   2. Lap flashing over water-resistive barrier at bottom and sides of openings.
   3. Lap water-resistive barrier over flashing at heads of openings.

3.3 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.
2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D4397, 10-mil- (0.25-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

PART 3 - EXECUTION

3.1 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. 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.

B. 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.

C. 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.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS IN CRAWL SPACES

A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches (305 mm) and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.

B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.

1. Extend vapor retarder vertically minimum 24 inches (610 mm) above top of footing.

C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

END OF SECTION 072600

SECTION 074100
PREFORMED METAL STANDING SEAM ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers the pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.
C. Related Work Specified Elsewhere
    1. Roof Deck structural steel, flat roof systems, perimeter edge systems. Roof hatches, firestopping not included in this section.

1.2 SUMMARY

A. Section Includes
    1. Factory formed Standing Seam metal roof panels
B. Related work specified elsewhere. (Note: select from the below or add appropriate sections)
    1. Section 07600 - Flashing and Sheet Metal

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight roofing system.
B. References:
    1. American Society for Testing and Materials (ASTM)
        a. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Process
        b. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process
        c. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate
        d. ASTM B370 Standard Specification for Copper Sheet and Strip for Building Construction
    2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
        a. SMACNA Architectural Sheet Metal Manual, 1993 edition
    3. American Iron and Steel Institute (AISI)
        a. AISI Cold Formed Steel Design Manual
    4. Aluminum Association
        a. Aluminum Design Manual
    5. Metal Construction Association
        a. Preformed metal Wall Guidelines
    6. Code References
        a. ASCE, Minimum Loads for Buildings and Other Structures
        b. BOCA National Building Codes
        c. UBC Uniform Building Code

d. SBC Standard Building Code

1.4 QUALITY ASSURANCE

A. Petersen Aluminum Corp, Elk Grove Village, IL, 800-323-1960 products establish a minimum of quality required.
B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.
C. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.5 SUBSTITUTIONS

A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by a proposed substitution.

1.6 SYSTEM DESCRIPTION

A. Material to comply with:
    1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

1.7 ROOF SYSTEM PERFORMANCE TESTING

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.
C. Panels to meet:
    1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
    2. Roof System shall be designed to meet a UL Class 90 wind uplift in accordance with UL standard 580 and panel system shall be ASTM 1592 Tested and approved
    3. UL 2218 - Impact Resistance rated.

1.8 WARRANTIES

A. Weathertight warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
    1. Warranty Period: 20 Years from date of Substantial Completion

B. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
    1. Exposed Panels Finish - deterioration includes 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 a paint to adhere to a bare metal.
    2. Warranty Period: 20 Years from the date of substantial completion
C. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

1.9 SUBMITTALS

A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
B. Provide finish samples of all colors specified.
C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels or metal soffit panels, details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
D. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, base don input from installer of the items involved:
    1. Roof panels and attachments
    2. Metal trusses, bracings and supports
    3. Roof-mounted items including snow guards and items mounted on roof curbs.
E. LEED Submittals
    1. Product Test reports for Credit SS 7.2. For roof panels, indicating that the panels comply with Solar Reflective Index requirement
    2. Product data for Credit MR 4.1 and credit MR 4.2: Indicating the percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

1.10 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.
B. Deliver components, sheets, metal roof panels and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.
D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof

panels in contact with other materials that might cause staining, denting or other surface damage.

E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.11 PROJECT CONDITIONS

A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed.
B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.12 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.
B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoining work to provide a leakproof, secure and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PANEL DESIGN

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.
B. Roof panels shall be Snap Clad standing seam in 16" widths with 1 3/4" high seam.
C. Panels to be produced with Factory supplied hot melt mastic in the seams.
D. Panels to be produced Smooth - Factory Standard.
E. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.
F. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.2 ACCEPTABLE MANUFACTURERS

A. This project is detailed around the roofing product of Petersen Aluminum Corporation Petersen Aluminum Corp, Elk Grove Village, IL, 800-323-1960, Snap Clad.
B. Provide products that comply with the criteria outlined in this specification by one of the following manufacturers:
    A. PAC-CLAD
    B. UNA-CLAD
    C. Or approved equal

2.3 MATERIALS AND FINISHES

A. Preformed roofing panels shall be fabricated of 24 GA Steel
B. Color shall be TBD
C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.
H. Substrate shall be Plywood
I. Roofing Underlayment
    1. On all surfaces to be covered with roofing material, furnish and install a 40 mil Peel & Stick membrane, required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, high temperature. **Basis of design:** Carlisle WIP 300 HT High Temperature Protection Self Adhering Roofing Underlayment. Other acceptable manufacturers include:
        a. W.R Grace "Ice & Water Shield"
        b. Interwrap Titanium PSU-30
        c. Tamko TW Tile and Metal Underlayment
    2. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6, and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
    3. Peel and Stick Underlayment shall lap all hips and ridges at least 12 to form double thickness and shall be lapped 6 over the metal of any valley or built-in gutters and shall be installed as required by the Standing Seam Panel Manufacturer to attain the desired 20 Year Weathertightness Warranty.
J. Sealants
    1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or
    2. one part polysulfide not containing pitch or phenolic extenders or
    3. Exterior grade silicone sealant recommended by roofing manufacturer or
    4. One part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.4 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
B. Fabricate components of the system in factory, ready for field assembly.
C. Fabricate components and assemble units to comply with fire performance requirements specified.
D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
B. For the record, 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 FASTENERS

A. Secure units to supports
B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiber-cement siding, trim and soffit.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For fiber-cement siding and soffit including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- (300-mm-) long-by-actual-width Sample of siding.
2. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding and soffit.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, 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. Furnish full lengths of fiber-cement siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
Build mockups for fiber-cement siding and soffit including accessories.

a. Size: 96 inches long by 96 inches (1800 mm) high
b. Include outside corner on one end of mockup and inside corner on other end.

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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. The manufacture for the basis of design shall be James Hardie Building Products

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch (8 mm).

D. Horizontal Pattern: Boards 6-1/4 to 6-1/2 inches (159 to 165 mm) wide in plain style.

1. Texture: Wood grain

E. Factory Priming: Manufacturer's standard acrylic primer.

F. Factory Finish: Manufacturer's standard acrylic finish.

2.3 FIBER-CEMENT TRIM

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. The manufacture for the basis of design shall be James Hardie Building Products

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Thickness: 1-inch

D. Board widths: As indicated on the drawings.

1. Texture: Smooth

E. Factory Priming: Manufacturer's standard acrylic primer.

F. Factory Finish: Manufacturer's standard acrylic finish.

2.4 FIBER-CEMENT SOFFIT

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
   1. The manufacture for the basis of design shall be James Hardie Building Products

B. Nominal Thickness: Not less than 5/16 inch (8 mm).

C. Pattern: 48-inch wide sheets with Smooth Beaded Board texture.

D. Ventilation: Provide unperforated soffit unless otherwise indicated.

E. Factory Priming: Manufacturer's standard acrylic primer.

F. Factory Finish: Manufacturer's standard acrylic finish.

2.5 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

   1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

   1. Finish for Aluminum Flashing: High-performance organic finish

C. Fasteners:

   1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
   2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
   3. For fastening fiber cement, use hot-dip galvanized fasteners.

D. Insect Screening for Soffit Vents: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh

E. Continuous Soffit Vents: Aluminum, hat-channel shape, with perforations; 2 inches (51 mm) wide and not less than 96 inches (2438 mm) long.

   1. Net-Free Area: 8 sq. in./linear ft. (560 sq. cm/m)
   2. Finish: White paint

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches (600 mm) o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

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SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Walkways.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with adjoining air barrier.

C. Samples: For the following products:

1. Roof membrane and flashings, of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for 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.

1.7 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. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): As indicated on structural drawings “Building Components & Cladding Wind Loads Diagram”
2. Zone 2 (Roof Area Perimeter): As indicated on structural drawings “Building Components & Cladding Wind Loads Diagram”

    a. Location: As indicated on structural drawings “Building Components & Cladding Wind Loads Diagram”

3. Zone 3 (Roof Area Corners): As indicated on structural drawings “Building Components & Cladding Wind Loads Diagram”

    a. Location: As indicated on structural drawings “Building Components & Cladding Wind Loads Diagram”

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 E108 or UL 790, Class B; 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.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Thickness: 60 mils (1.5 mm), nominal.
2. Typical Exposed Face Color: White
3. Exposed Face Color at Roof above Retail Space: Gray

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard.

E. Slip Sheet: Manufacturer's standard, of thickness required for application.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   1. Size: 48 by 96 inches (1219 by 2438 mm).
   2. Thickness at Steel/Concrete Deck Roof:
      a. Base Layer: 2-3/4 inches
      b. Upper Layer: 2-3/4 inches
   3. Thickness at wood deck roof:
      a. Base Layer: 1-1/2 inches

B. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   2. Minimum Thickness: 1/4 inch (6.35 mm).
   3. Slope:
      a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
      b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

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.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

C. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches (914 by 1524 mm).
2. Color: Contrasting with roof membrane.

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 minimum concrete drying period recommended by roofing system manufacturer has passed.
2. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.

    a. Test Frequency: One test probe per each 1000 sq. ft. (93 sq. m) or portion thereof, of roof deck, with not less than three tests probes.
    b. Submit test reports within 24 hours after performing tests.

3. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

4. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.

3.2 PREPARATION

A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours after performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.

a. Locate end joints over crests of decking.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2) Or set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Wood Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood decks.
a. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.

c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

1) Trim insulation so that water flow is unrestricted.

d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
f. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
   a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

      1) Trim insulation so that water flow is unrestricted.

   e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

E. Installation Over Concrete Decks:

1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
   a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

      1) Trim insulation so that water flow is unrestricted.

   d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
   f. Adhere base layer of insulation to concrete roof deck according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
      1) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

2) Or set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
   a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

      1) Trim insulation so that water flow is unrestricted.

   e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
   g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
      1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      2) Or set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF ADHERED ROOFING

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

G. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

H. Apply roof membrane with side laps shingled with slope of roof deck where possible.

I. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.6 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 INSTALLATION OF WALKWAYS

A. Flexible Walkways:

1. Install flexible walkways at the following locations:

a. Retain one or more subparagraphs below. Revise to suit Project.
b. Perimeter of each rooftop unit.
c. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
d. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
e. Top and bottom of each roof access ladder.

f. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
g. Locations indicated on Drawings.
h. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch (76-mm) clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system 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. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.

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, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

B. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special warranty.

1.5 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. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.6 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 Delta units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
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, including cleats, anchors, and fasteners, 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 NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings

D. 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 (67 deg C), ambient; 180 deg F (100 deg C), 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 zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.
1. Surface: Smooth, flat
2. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (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 (0.013 mm).

C. Lead Sheet: ASTM B749 lead sheet.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) 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 in accordance with underlayment manufacturer's written instructions.
1. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, 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 Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. 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 (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

H. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.

2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
5. Accessories:

    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

6. Finish: With manufacturer's standard color coating

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. 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.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. 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.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. 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 (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:
1. 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.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- (2400-mm-) long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen
6. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
   a. Galvanized Steel: 0.022 inch (0.56 mm) thick.
7. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch (0.71 mm)thick.
8. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
   a. Galvanized Steel: 0.034 inch (0.86 mm) thick.
9. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following materials:
   a. Galvanized Steel: 0.040 inch (1.02 mm) thick.
10. Gutters with Girth 31 to 35 Inches (790 to 890 mm): Fabricate from the following materials:
   a. Galvanized Steel: 0.052 inch (1.32 mm) thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.022 inch (0.56 mm) thick.

C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.

   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.040 inch (1.02 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

   1. Install in shingle fashion to shed water.
   2. Lap joints not less than 2 inches (50 mm).

B. Self-Adhering, High-Temperature Sheet Underlayment:

   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.

3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

C. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches (100 mm).

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
7. Do not field cut sheet metal flashing and trim by torch.

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 cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

D. 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.

E. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

F. Rivets: Rivet joints in zinc where necessary for strength.

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet (15.2 m) apart. Install expansion-joint caps.
7. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts:

1. Join sections with 1-1/2-inch (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
4. Connect downspouts to underground drainage system.

D. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.

E. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch (25 mm) below scupper or gutter discharge.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).

F. 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 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

3.7 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. 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, as determined by Architect.

END OF SECTION 076200

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples: For each type of roof specialty and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For tests performed by a qualified testing agency.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
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. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. The basis of design is Metal Era; Perma-Tite or Perma-Tite Gold coping system, other equal manufacturer’s systems will be considered by the Architect.
2. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal thickness as required to meet performance requirements

a. Surface: Smooth, flat finish.
b. Finish: Three-coat fluoropolymer
c. Color: As selected by Architect from manufacturer's full range

3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Coping-Cap Attachment Method: face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
a. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet

2.3 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. The basis of design is Metal Era; Anchor-Tite Standard Fascia system, approved equals will be considered by the Architect.
2. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal thickness as required to meet performance requirements

    a. Surface: Smooth, flat finish.
    b. Finish: Three-coat fluoropolymer
    c. Color: As selected by Architect from manufacturer's full range

3. Corners: Factory mitered and mechanically clinched and sealed watertight.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Receiver: Extruded aluminum, 0.080 inch (2.03 mm) thick

2.4 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C).

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FINISHES

A. Coil-Coated Galvanized-Steel Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.
   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.

B. Copper Sheet Finishes:

1. Non-Patinated Finish: Mill finish.
2. Pre-Patinated Finish: Chemically treated according to ASTM B882.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration 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."
3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, 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.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

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 system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

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. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming 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.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
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.

3.2 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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.

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

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 E1966 or UL 2079.

1. 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 at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.

1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

F. Accessories: Provide components of joint firestopping 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 INSTALLATION

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. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. 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.

D. Install elastomeric fill materials for joint firestopping 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.

3.2 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.

3.3 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

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.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples: For each kind and color of joint sealant required.

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.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.
B. Preconstruction laboratory test reports.
C. Preconstruction field-adhesion-test reports.
D. Field-adhesion-test reports.
E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with cultured stone, cast stone, and masonry substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1.7 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.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.

D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

E. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

F. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.

G. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

H. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

I. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

J. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

C. 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 C920, Type S, Grade NS, Class 50, Use NT.

D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

2.4 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 C920, Type S, Grade NS, Class 25, Use NT.

B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.

E. 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 C920, Type S, Grade P, Class 25, Uses T and NT.

F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.

I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.

J. 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 C920, Type M, Grade P, Class 50, Uses T and NT.

K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. 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 C920, Type S, Grade NS, Class 25, Use NT.

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.6 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), and 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.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.7 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.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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 laitance and form-release agents from concrete.
2. 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.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. 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.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. 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.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 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 C1193 or Method A, Tail Procedure, in ASTM C1521.

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.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Control and expansion joints in brick pavers.
    b. Isolation and contraction joints in cast-in-place concrete slabs.
    c. Joints between plant-precast architectural concrete paving units.
    d. Joints in stone paving units**,** including steps.
    e. Tile control and expansion joints.
    f. Joints between different materials listed above.
    g. 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. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in dimension stone cladding.
    e. 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 stone flooring.
    c. Control and expansion joints in brick flooring.
    d. Control and expansion joints in tile flooring.
    e. 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 unit masonry, concrete, walls and partitions.
   d. Joints on underside of plant-precast structural concrete beams and planks.
   e. 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

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SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Samples: For each kind and color of acoustical joint sealant required.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 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.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical 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: 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 E90.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
   1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors

B. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

C. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 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 C919, ASTM C1193, 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.

END OF SECTION 079219

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SECTION 08 14 23 -ALUMINUM-CLAD WOOD HINGED DOORS & SIDELIGHTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-clad wood hinged doors with sidelights.

1.2 RELATED SECTIONS

A. Section 07270 (07 27 00) - Air Barriers: Water-resistant barrier.
B. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.
C. Section 08710 (08 71 00) - Door Hardware.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
   2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):
   1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
   2. ASTM C 1036 - Flat Glass.
   3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
   5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
   6. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
   7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
   8. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
   9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
   10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
   11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   12. ASTM G 85 - Modified Salt Spray (Fog) Testing.

C. Screen Manufacturers Association (SMA):
   1. SMA 1201 - Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.

D. Window and Door Manufacturers Association (WDMA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for windows, doors and skylights
   2. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

1.4 PERFORMANCE REQUIREMENTS

A. Doors shall be Hallmark certified to a rating of HGD – LC–PG20 specifications in accordance with ANSI/AAMA/WDMA 101/I.S.2/A440-08 or ANSI/AAMA/WDMA 101/I.S.2/A440-11.

B. Door Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.15 cfm per square foot of frame or less.

1.5 SUBMITTALS

A. Comply with Division 1 requirements.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

D. Warranty: Submit manufacturer’s standard warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.

B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.

C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.

2.2 ALUMINUM-CLAD WOOD HINGED DOOR

A. Aluminum-Clad Wood Out-swing Door: Architect Series factory-assembled aluminum-clad wood doors with outward swing door panels installed in frame.

B. Frame:
1. Select woods, water water-repellent, preservative-treated with EnduraGuard™ in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
2. Interior Exposed Surfaces: Clear Pine, veneered and edge-banded with no visible fastener holes.
3. Exterior Surfaces: Clad with aluminum at head and jambs.
4. Sill: /2-inch low-profile extruded aluminum with bronze anodized
5. Overall Frame Depth: 5-7/8 inches (149 mm).

C. Weather Strip: Dual-durometer extruded polymer along perimeter of door frames and along the bottom of door panels.

2.3 GLAZING

A. Glazing:
   1. Float Glass: ASTM C 1036, Quality 1.
      a. Tempered Glass: ASTM C 1048.

   2. Type: Silicone-glazed 1” triple-pane, dual-seal, fully tempered, insulating glass, multi-layer Low-E coated with argon.

   3. Integral Light Technology Glazing and Grilles on sidelights:
      a. Insulating glass contains non-glare spacer between the panes of glass.
      b. Grid: Adhered to glass on double pane and a metal spacer on triple pane.

2.4 HARDWARE

A. Handles:
   1. By other.
B. Locking System:
   1. By other.
C. Hinges:
   1. Corrosion-resistant leaves with wear-resistant hinge bushings and stainless steel pin and decorative cap.
   2. Doors with Frame Heights Greater than 7’ 0”: 4 hinges.
   3. Finish:
      a. Out-Swing Doors: Match exterior door cladding.

2.5 TOLERANCES

A. Doors shall accommodate the following opening tolerances:
   1. Vertical Dimensions Between High and Low Points: Plus 1/8 inch, minus 0 inch.
   2. Width Dimensions: Plus 1/8 inch, minus 0 inch.
   3. Building Columns or Masonry Openings: Plus or minus 1/8 inch from plumb.

2.6 FINISH

A. Exterior Finish System: Pella EnduraClad.
   1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
      a. Clean and etch aluminum surface of oxides.
      b. Pre-treat with conversion coating.
      c. Top coat with baked-on polyester enamel.
   2. Color: Black
   3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2603 and the following performance requirements of AAMA 2605:
      a. Dry Film Hardness: Eagle Turquoise Pencil, H minimum.
      b. Film Adhesion: 1 mm crosshatch, dry, wet, boiling water.
      c. Impact Resistance: 1/10-inch distortion, no film removal.
      d. Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24 hours.
      e. Detergent Resistance: 3 percent at 100 degrees F, 72 hours.
      f. Corrosion Resistance: ASTM G85-A5, 2000 hours. Humidity, 3,000 hours. Salt spray exceeds 3,000 hours.
B. Interior Finish: Factory-primed with 1 coat acrylic latex

2.7 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape:
   1. Aluminum-foil-backed butyl window and door flashing tape.
   2. Maximum Total Thickness: 0.013 inch.
   3. UV resistant.
   4. Verify sealant compatibility with sealant manufacturer.

B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

C. Exterior Perimeter Sealant: Use high quality, multi-purpose sealant as specified in the joints sealant section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and approved shop drawings.

B. Install doors to be weather-tight and freely operating.

C. Maintain alignment with adjacent work.

D. Secure assembly to framed openings, plumb and square, without distortion.

E. Integrate door system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with door manufacturer's instructions.

F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant.

G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

H. Leave doors closed and locked with shoot bolts extended.

3.3 CLEANING

A. Clean door frames and glass in accordance with Division 1 requirements.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. Remove labels and visible markings.

3.4 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior stile and rail wood doors.
   2. Interior fire-rated stile and rail wood doors.
   3. Fire-rated wood door frames.
   4. Factory fitting stile and rail wood doors to frames and factory machining for hardware.
   5. Factory priming

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

   1. Details of construction and glazing.
   2. Door frame construction.
   3. Factory-machining criteria.
   4. Factory-priming specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

   1. Door schedule indicating door location, type, size, fire protection rating, and swing.
   2. Door elevations, dimensions and location of hardware, lite locations, and glazing thickness.
   3. Details of frame for each frame type, including dimensions and profile.
   4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   5. Clearances and undercuts.
   6. Requirements for veneer matching.
   7. Apply AWI Quality Certification Program label to Shop Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

   1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
   2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, section 7.2.1.15.4.

3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

C. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to UL 10C or NFPA 252.
1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: 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.

2.2 MATERIALS

A. Use only materials that comply with referenced standards and other requirements specified.

1. Assemble exterior doors, including components, with wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.
2. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.

B. Panel Products: Any of the following unless otherwise indicated:

1. Particleboard: ANSI A208.1, Grade M-2.
2. Medium-density fiberboard (MDF,) complying with ANSI A208.2, Grade 130.
3. Hardboard complying with ANSI A135.4.
4. Veneer-core plywood.

C. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.3 INTERIOR STILE AND RAIL WOOD DOORS

A. Interior Stile and Rail Wood Doors (Interior unit doors): Interior stock doors complying with AWI, AWMAC, and WI's Architectural Woodwork Standards and with other requirements specified.
1. Performance Grade: WDMA I.S. 6A Standard Duty
2. Thickness: 1 3/8-inch
3. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
4. Finish: Opaque.

5. Door Construction for Opaque Finish:
   a. Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber.
   b. Raised-Panel Construction: Shaped, medium-density fiberboard.

6. Stile and Rail Widths: As indicated

   a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm)
   b. Bottom Rails: 10 inches

7. Raised-Panel Thickness: Not less than 1-1/8 inches thick
8. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.

9. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick complying with Section 088000 "Glazing."
10. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.4 INTERIOR FIRE-RATED STILE AND RAIL WOOD DOORS

A. Interior Fire-Rated Stile and Rail Wood Doors (Unit entry doors): Fire-rated (20-minute rating) doors complying with AWI, AWMAC, and WI's Architectural Woodwork Standards and with other requirements specified.
   1. Performance Grade: WDMA I.S. 6A Heavy Duty
   2. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
   3. Finish: Opaque.
   4. Door Construction for Opaque Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered raised panels not less than 1-1/8 inches (29 mm) thick.
      a. Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber.
      b. Raised-Panel Construction: Shaped medium-density fiberboard (MDF.)
      c. Edge Construction for Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
      d. Edge Construction for Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
         1) Finish steel edges and astragals with baked enamel same color as doors.
   5. Stile and Rail Widths: As indicated
      a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm)
      b. Bottom Rails: 10 inches
   6. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.
   7. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.5 STILE AND RAIL WOOD DOOR FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
   1. Clearances:
      a. Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors.

b. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering.
c. Where threshold is shown on Drawings or scheduled, provide not more than 3/8 inch (10 mm) from bottom of door to top of threshold.
d. Comply with NFPA 80 requirements for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.

B. Fabricate stile and rail wood doors in sizes indicated for field fitting.

C. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
4. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Glazed Openings: Trim openings indicated for glazing with solid-wood moldings, with one side removable. Miter wood moldings at corner joints.

2.6 FACTORY PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated door frames according to NFPA 80.

a. Install frames level, plumb, true, and straight.

1) Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).

b. Anchor frames to anchors or blocking built in or directly attached to substrates.

1) Secure with countersunk, concealed fasteners and blind nailing.
2) Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.

c. For shop-finished items, use filler matching finish of items being installed.

2. Install fire-rated doors according to NFPA 80.
3. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.
3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081433

SECTION 08 32 16 - VINYL SLIDING PATIO DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vinyl sliding patio doors.

1.2 RELATED REQUIREMENTS

A. Section 07 27 00 – Air Barriers: Water-resistant barrier.

B. Section 07 92 00 – Joint Sealants: Sealants.

1.3 REFERENCE STANDARDS

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 303 - Voluntary Specification for Poly (Vinyl Chloride) (PVC) Exterior Profile Extrusions; American Architectural Manufacturers Association.
2. AAMA 502 – Voluntary Specification for Field Testing of Newly Installed Fenestration Products
3. AAMA 613 – Voluntary Performance Requirements and Test Procedures For Organic Coatings On Plastic Profiles.

B. ASTM International (ASTM):
1. ASTM C 1036 – Standard Specification for Flat Glass.
2. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM D 1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
4. ASTM D 3656 – Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
5. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM F 588 – Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

C. Screen Manufacturers Association (SMA):
1. SMA 1201 – Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.

D. Window and Door Manufacturers Association (WDMA):
1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

D. Samples: Submit full-size or partial full-size sample of vinyl sliding patio doors illustrating glazing system, quality of construction, and color of finish.

E. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

F. Cleaning and Maintenance Instructions: Submit manufacturer’s cleaning and maintenance instructions.

G. Warranty Documentation: Submit manufacturer’s standard warranty.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications:
1. Installer regularly engaged, for past 5 years, in installation of vinyl sliding patio doors of similar type to that specified.
2. Employ persons trained for installation of vinyl sliding patio doors.

B. Mock-ups:
1. Provide sample installation for field testing door performance requirements and to determine acceptability of door installation methods.
2. Approved mock-ups shall represent minimum quality required for the Work.
3. Approved mock-ups shall not remain in place within the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver doors to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name.
2. Include installation instructions.

B. Storage and Handling:
1. Store and handle doors in accordance with manufacturer's instructions.
2. Store doors off ground and under cover.
3. Provide full support under framework when storing, handling, and installing doors.
4. Allow sufficient spacing between doors during storage for ventilation.
5. Do not lift doors by head member only.
6. Protect doors from weather, direct sunlight, and construction activities.
7. Protect doors and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free 800-54-PELLA. Phone 641-621-1000. Website www.pella.com.

2.2 PERFORMANCE REQUIREMENTS

A. Performance:
1. Meets or exceeds AAMA/WDMA/CSA 101/I.S.2/A440 Ratings: SD-R50, WDMA Hallmark Certified.
2. Air Infiltration, 1.57 psf wind pressure: 0.30 cfm/ft^2 of frame.
3. Design Pressure: 50 psf.
4. Water Resistance: 7.5 psf.

B. Forced Entry Resistance, ASTM F 842, Minimum Security Grade: 10.

C. Maximum Operating Force:
1. Initiate Motion: 30 lbs.
2. Maintain Motion: 20 lbs.

D. Meets U.S. ENERGY STAR guidelines.

2.3 VINYL SLIDING PATIO DOORS

A. Vinyl Sliding Patio Doors: Pella 250 Series.

B. Frame:
1. Interior and Exterior Frame Surfaces: Extruded, rigid, polyvinyl chloride (uPVC) complying with AAMA 303, having minimum ignition temperature 824 degrees F. when tested in accordance with ASTM D 1929.
2. Overall Frame Depth: 5 inches.
3. Frame Members: Mitered and heat fused to provide fully welded corner assembly.
4. Sill: Fitted with weeps.
5. Frame Type:
a. Setback Nail Fin, 1-1/8 inches: For 3-7/8-inch wall depth.

C. Door Panels:
1. Door Panel: Extruded, rigid, uPVC.
2. Panel Members: Mitered and heat fused to provide fully welded corner assembly.
3. Vent Panels:
a. Fully operable for ventilation.
b. Two adjustable rollers, set on stainless steel track cap.
4. Contains sealed insulating glass.
5. Wet glazed with polyurethane-reactive hotmelt.

D. Insulating Glazing:
1. Float Glass: ASTM C 1036.
2. Exterior face-glazed sealed insulating glass.

3. Dual-Pane Insulating Glass:
   a. Total Thickness: 3/4 inch.
   b. Tempered Safety Glass: ASTM C 1048.
   c. Advanced Low-E coated, with argon.

E. Weatherstripping: Fin-type pile around perimeter of vent panel.

2.4 HARDWARE

A. Interior Handle and Thumb Lock:
   1. Finish: Match door interior.

B. Accessory Foot-bolt Locking Device, Factory Installed, Color Matched to Interior

C. Exterior Handle:
   1. Finish: Match door exterior.

D. Exterior Keylock: Schlage configured “C” key-way pin-lock cylinder.

E. Multipoint Lock: Electroplated steel.

F. Door Rollers:
   1. Adjustable.
   2. Permanently sealed.
   3. Material: Electroplated steel with organic-coated ball-bearing rollers.

G. Fasteners: Corrosion-resistant, uPVC-compatible material.

2.5 SCREENS

A. Screens:
   1. Compliance:
      a. ASTM D 3656.
      b. SMA 1201
   2. Sliding.
   3. Full size.
   4. Screen Cloth: Black, vinyl-coated, 18/14 mesh, fiberglass screen cloth.
   5. Set in extruded aluminum frame.
   6. Four self-adjustable rollers.
   7. Latch.
   8. Latch handle.

2.6 TOLERANCES

A. Doors shall accommodate the following opening tolerances:
   1. Horizontal Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
   2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
   3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

2.7 FINISH

A. Exposed uPVC Surfaces: Smooth, glossy, and uniform in appearance.

B. Frame Colors:
   1. Exterior/Interior:
      a. Black exterior, consisting of a solar reflective coating exceeding AAMA 613 test requirements, with White integral color extruded throughout the profiles on the interior.

2.8 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape: Pella “SmartFlash”.
   1. Aluminum-foil-backed butyl window and door flashing tape.
   2. Maximum Total Thickness: 0.013 inch.
   3. UV resistant.
   4. Verify sealant compatibility with sealant manufacturer.

B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

C. Exterior Perimeter Sealant: “Pella Window and Door Installation Sealant” or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine rough opening to receive vinyl sliding patio doors.
   1. Verify rough opening is plumb, level, square, and of proper dimensions.
   2. Verify a minimum of 1-1/2 inches of solid wood blocking is installed around perimeter of rough opening.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install vinyl sliding patio doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, and without distortion.

C. Maintain alignment with adjacent work.

D. Install doors to be weathertight.

E. Install doors to be freely operating.

F. Verify proper operation of operating hardware.

G. Integrate door installation with exterior weather-resistant barrier using flashing/sealant tape.
   1. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with door manufacturer's instructions.

H. Seal doors to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

I. Place interior seal around vinyl door perimeter to maintain continuity of building thermal and air barrier using [backer rod and sealant] [insulating-foam sealant].

J. Leave doors closed and locked.

3.3 FIELD QUALITY CONTROL

A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

B. Initial field testing must be performed prior to no more than 5% of windows have been installed. All field testing expenses shall be at the burden of the contractor.

3.4 CLEANING

A. Clean vinyl sliding patio doors in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish, vinyl, or glass.

C. Remove labels and visible markings.

D. Keep door tracks clear of dirt and debris.

E. Keep weep holes open and clear of obstructions.

3.5 PROTECTION

A. Protect installed vinyl sliding patio doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION08 53 13 - VINYL SINGLE-HUNG WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vinyl single-hung windows.

B. Vinyl Fixed Windows

1.2 RELATED REQUIREMENTS

A. Section 07 27 00 – Air Barriers: Water-resistant barrier.

B. Section 07 92 00 – Joint Sealants: Sealants.

1.3 REFERENCE STANDARDS

A. American Architectural Manufacturers Association (AAMA):
1. AAMA 303 - Voluntary Specification for Poly (Vinyl Chloride) (PVC) Exterior Profile Extrusions; American Architectural Manufacturers Association.
2. AAMA 502 – Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
3. AAMA 613 – Voluntary Performance Requirements and Test Procedures For Organic Coatings On Plastic Profiles.

B. ASTM International (ASTM):
1. ASTM C 1036 – Standard Specification for Flat Glass.
2. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM D 1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
4. ASTM D 3656 – Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
5. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM F 588 – Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

C. Screen Manufacturers Association (SMA):
1. SMA 1201 – Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors.

D. Window and Door Manufacturers Association (WDMA):

1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

D. Samples: Submit full-size or partial full-size sample of vinyl single-hung windows illustrating glazing system, quality of construction, and color of finish.

E. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

F. Cleaning and Maintenance Instructions: Submit manufacturer’s cleaning and maintenance instructions.

G. Warranty Documentation: Submit manufacturer’s standard warranty.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications:
1. Installer regularly engaged, for past 5 years, in installation of vinyl single-hung windows of similar type to that specified.
2. Employ persons trained for installation of vinyl single-hung windows.

B. Mock-ups:
1. Provide sample installation for field testing window performance requirements and to determine acceptability of window installation methods.
2. Approved mock-ups shall represent minimum quality required for the Work.
3. Approved mock-ups shall not remain in place within the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver windows to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name.
2. Include installation instructions.

B. Storage and Handling:
1. Store and handle windows in accordance with manufacturer's instructions.
2. Store windows off ground and under cover.
3. Provide full support under framework when storing, handling, and installing windows.
4. Allow sufficient spacing between windows during storage for ventilation.

5. Do not lift windows by head member only.
6. Protect windows from weather, direct sunlight, and construction activities.
7. Protect windows and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free 800-54-PELLA. Phone 641-621-1000. Website www.pella.com.

2.2 PERFORMANCE REQUIREMENTS

A. Standard Performance:
1. Meets or exceeds AAMA/WDMA/CSA 101/I.S.2/A440 Ratings: R-PG35, WDMA Hallmark Certified.
2. Unit assembly shall withstand both positive and negative uniform static air pressure difference without damage when tested according to ASTM E 330.
3. Air Infiltration, 1.57 psf wind pressure: 0.30 cfm/ft^2 of frame.
4. Design Pressure: 35 psf.
5. Water Penetration Resistance: 5.43 psf.

B. Forced Entry Resistance, ASTM F 588, Minimum Security Grade: 10.

C. Maximum Operating Force:
1. Initiate Motion: 35 lbs.
2. Maintain Motion: 20 lbs.

D. Meets U.S. ENERGY STAR guidelines.

2.3 VINYL SINGLE-HUNG WINDOWS

A. Vinyl Single-hung Windows: Pella “250 Series”.

B. Frame:
1. Interior and Exterior Frame Surfaces: Extruded, rigid, polyvinyl chloride (uPVC) complying with AAMA 303, having minimum ignition temperature 824 degrees F. when tested in accordance with ASTM D 1929.
2. Overall Frame Depth: 3-1/4 inches.
3. Frame Members: Mitered and heat fused to provide fully welded corner assembly.
4. Sill: Fitted with weeps.
5. Frame Type:
   a. Setback Nail Fin, 1-1/8 inches: For 2-1/8-inch wall depth.

C. Sash:
1. Sash Members:
   a. Extruded, rigid, uPVC complying with AAMA 303, having minimum ignition temperature 824 degrees F. when tested in accordance with ASTM D 1929.

b. Mitered and heat fused to provide fully welded corner assembly.
2. Integral extruded sash lift.
3. Contains sealed insulating glass.

D. Glazing:
1. Float Glass: ASTM C 1036.
a. Glass Type: [Annealed] [Tempered safety glass, ASTM C 1048].
b. Tempered where required by code.
2. Exterior tape-glazed sealed insulating glass.
3. Dual-Pane Insulating Glass:
a. Total Thickness: 3/4 inch.
b. Advanced Low-E coated, with argon.

E. Weatherstripping:
1. Sash: Weatherstripped around sash perimeter with fin-type, pile weatherstripping in 3 locations.

2.4 HARDWARE

A. Balances: Inverted Constant Force Stainless Steel Coil Balances.

B. Locks: Factory-installed, zinc-die-cast, self-aligning, cam-action locks located on check rail.
1. Sash Locks: Two sash locks installed on windows with minimum of 29-1/2 inches frame width.

C. Tilt Latches: Factory-installed, nylon, located on check rail of lower sash.

D. Fasteners: Corrosion-resistant, uPVC-compatible material.

E. Hardware Finish: Match window interior.

2.5 SCREENS

A. Screens: Standard half screen.
1. Compliance:
a. ASTM D 3656.
b. SMA 1201
2. Screen Cloth: Black, vinyl-coated, 18/16 mesh, fiberglass screen cloth.
3. Set in roll formed coil aluminum frame and fitted to exterior of windows.
4. Screen Frame Finish: Baked enamel.
a. Color: Match window exterior.

2.6 TOLERANCES

A. Windows shall accommodate the following opening tolerances:
1. Horizontal Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

2.7 FINISH

A. Exposed uPVC Surfaces: Smooth, glossy, and uniform in appearance.

B. Frame Colors:
1. Exterior/Interior:
    a. Black exterior, consisting of a solar reflective coating exceeding AAMA 613 test requirements, with White integral color extruded throughout the profiles on the interior.

2.8 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape: Pella “SmartFlash”.
1. Aluminum-foil-backed butyl window and door flashing tape.
2. Maximum Total Thickness: 0.013 inch.
3. UV resistant.
4. Verify sealant compatibility with sealant manufacturer.

B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

C. Exterior Perimeter Sealant: “Pella Window and Door Installation Sealant” or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine rough opening to receive vinyl single-hung windows.
1. Verify rough opening is plumb, level, square, and of proper dimensions.
2. Verify a minimum of 1-1/2 inches of solid wood blocking is installed around perimeter of rough opening.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install vinyl single-hung windows in accordance with manufacturer's instructions.

B. Install windows plumb, level, square, and without distortion.

C. Maintain alignment with adjacent work.

D. Install windows to be weathertight.

E. Install windows to be freely operating.

F. Verify proper operation of operating hardware.

G. Integrate window installation with exterior weather-resistant barrier using flashing/sealant tape.
1. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with window manufacturer's instructions.

H. Seal windows to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

I. Place interior seal around vinyl window perimeter to maintain continuity of building thermal and air barrier using [backer rod and sealant] [insulating-foam sealant].

J. Leave windows closed and locked.

3.3 FIELD QUALITY CONTROL

A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

B. Initial field testing must be performed prior to no more than 5% of windows have been installed. All field testing expenses shall be at the burden of the contractor.

3.4 CLEANING

A. Clean vinyl single-hung windows in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish, vinyl, or glass.

C. Remove labels and visible markings.

D. Keep window tracks clear of dirt and debris.

E. Keep weep holes open and clear of obstructions.

3.5 PROTECTION

A. Protect installed vinyl single-hung windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

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 1 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.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 08 Section “Automatic Door Operators”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

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.
   h. Warranty information for each product.

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.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. 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 Procedures.

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: A minimum 3 years documented experience installing both standard and electrified door 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 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.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source 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. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." 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.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" 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

H. 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 and Frame Preparation: 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. Seven years for heavy duty cylindrical (bored) locks and latches.
3. Twenty five years for manual overhead door closer bodies.

4. Five years for motorized electric latch retraction exit devices.
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.

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.

B. 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:

1. 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.

C. 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 and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. 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 3’6” 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, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

    a. Non-removable Pins: With the exception of electric through wire hinges, 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 all out-swinging lockable doors.

5. Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA).
    c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA).
    c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.

2. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.

3. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.

4. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.

5. Manufacturers:

   a. Hager Companies (HA).
   b. Johnson Hardware (JO).
   c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges 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. Manufacturers:

      a. Hager Companies (HA) - ETW-QC (# wires) Option.
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.

B. 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. Manufacturers:

      a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) - EL-CEPT Series.
      b. Securitron (SU) - EL-CEPT Series.
      c. Von Duprin (VD) - EPT-10 Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

   1. Provide one each of the following tools as part of the base bid contract:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. Hager Companies (HA) - Quick Connect.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. 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.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Hager Companies (HA)
b. Burns Manufacturing (BU).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
d. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Hager Companies (HA)
b. Burns Manufacturing (BU).
c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
d. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified 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. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. 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.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Hager Companies (HA)
    b. Burns Manufacturing (BU).
    c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    d. Trimco (TC).

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. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. 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.
6. Keyway: Match Facility Standard.

D. Removable Cores: Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)

2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

G. Construction Keying: Provide construction master keyed cylinders.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

a. dormakaba Best (BE)
b. Hager Companies (HA).
c. Schlage (SC).
d. Yale Commercial(YA) - 8800FL Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

2. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

3. Locks are to be non-handed and fully field reversible.

4. Manufacturers:

    a. dormakaba Best (BE)
    b. Hager Companies (HA).
    c. Schlage (SC) - ND Series.
    d. Yale Commercial(YA) 5400LN Series.

C. Residential Tubular Locking Devices: Standard ANSI A156.2, Series 4000, Grade 2.

1. Tubular locksets, deadbolts, and handlesets designed to fit ANSI standard door preps.

2. Locks are to be non-handed and have adjustable backset.

3. Manufacturers:

    a. dormakaba Best (BE)
    b. Hager Companies (HA).
    c. Schlage (SC) - TL Series.
    d. Yale Residential (YR) - YH Series.

2.8 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. Manufacturers:

    a. dormakaba Best (BE)
    b. Hager Companies (HA).
    c. Schlage (SC) - L9000 EL/EU/RX Series.
    d. Yale Commercial(YA) - 8800FL Series.

B. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Manufacturers:

    a. dormakaba Best (BE)
    b. Hager Companies (HA).
    c. Schlage (SC) - ND DEL/DEU Series.
    d. Yale Commercial(YA) - 5400LN Series.

2.9 AUXILIARY LOCKS

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 certified narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

    a. Adams Rite Manufacturing (AD) - 4900 Series.

2.10 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 Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing 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 Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes tested to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability with field selectable fail-secure/fail-safe. Where specified provide latchbolt monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Manufacturers:

   a. Adams Rite (AD) - 7100 Series.
   b. HES (HS) - 5000/5200 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.12 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 pushbar 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 required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with 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.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

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 (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

1. Manufacturers:

   a. Hager Companies (HA) 4500 Series.
   b. Von Duprin (VD) 35A/98 XP Series
   c. Yale Commercial(YA) - 6000 Series.

2.13 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

3. Manufacturers:

   a. Hager Companies (HA) 4500 Series.
   b. Von Duprin (VD) 35A/98 XP Series
   c. Yale Commercial(YA) - 6000 Series.

2.14 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.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. 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 Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed 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 backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

   a. Hager Companies (HA) 5200 Series.
   b. Norton Door Controls (NO) - 7500 Series.
   c. Sargent Manufacturing (SA) - 351 Series.
   d. Yale Commercial(YA) - 4400 Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade 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 backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

    a. Hager Companies (HA) - 5100 Series.
    b. Norton Door Controls (NO) - 8500 Series.
    c. Sargent Manufacturing (SA) - 1431 Series.
    d. Yale Commercial(YA) - 3500 Series.

D. Door Closers, Surface Mounted (Utility Grade): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, utility grade door closers with complete spring power adjustment, sizes 1 thru 6. Closers to be rack and pinion type, cast aluminum case construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide closer standard packed for regular, top-jamb, and parallel arm type mounting applications.

1. Manufacturers:

    a. Hager Companies (HA) - 5300 Series.
    b. Norton Door Controls (NO) - 1601 Series.
    c. Sargent Manufacturing (SA) - 1131 Series.
    d. Yale Commercial(YA) - 51BC Series.

2.15 ELECTROHYDRAULIC DOOR OPERATORS

A. General: Provide low energy 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. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. 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.
2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 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.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, 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.

G. 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.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. LCN Closers (LC) - 4640 Series.
2. Norton Door Controls (NO) - 6000 Series.
3. Stanley Security Solutions (ST) - D-4990 Series.

2.16 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. Rixson (RF) - 980/990 Series.
b. Sargent Manufacturing (SA) - 1560 Series.

2.17 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. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Hager Companies (HA).
    b. Hiawatha, Inc. (HI).
    c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.18 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. Manufacturers:

    a. Hager Companies (HA).
    b. Hiawatha, Inc. (HI).
    c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.19 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 NPFA 252, Standard Methods of 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.

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. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.20 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. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Linear 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 plus 50% for the specified electrified hardware and access control equipment.

1. 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.

2. Manufacturers:

a. Securitron (SU) - BPS Series.

b. Yale Commercial(YA) 782.

2.21 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.

2.22 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 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 ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
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 7 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 (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
2. Submit documentation of incomplete items in the following formats:

    a. PDF electronic file.
    b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

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. 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 SETS

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.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron

4. RF - Rixson
5. RO - Rockwood
6. YA - Yale
7. YR - Yale Residential
8. SA - SARGENT
9. AD - Adams Rite
10. NO - Norton
11. GS - ASSA ABLOY Glass Solutions
12. SO - SOSS Invisible Hinges

Hardware Sets

Set: 1
Doors: U1
Description: UNIT ENTRY

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US4	MK
1	Keyless Entry Lock w/Deadbolt	Salto Lockset (BTE) coordinate credentials		US4 SA
1	Surface Closer	1601	696	NO
1	Kick Plate	K1050 10" x 2" LDW 4BE CSK	US4	RO
1	Wall Stop	409	US4	RO
1	Frame Protection Pads	ACP112BL		PE
1	Door Bottom, concealed	434APKL		PE
1	Viewer	629	BR	RO
1	Threshold	171G		PE
1	Gasketing	S88D		PE
1	Rain Guard	346G		PE
1	ElectroLynx Harness	QC-hinge/power transfer to ceiling		MK
1	ElectroLynx Harness	QC- (size to door width/hardware)		MK

Notes: ACCESS BY KEYLESS CREDENTIAL. ALWAYS FREE EGRESS. SALTO XS4 MINI.

Set: 2
Doors: U7
Description: BEDROOM / BATHROOM

3	Hinge, Full Mortise	T2714 4" x 4"	US4	MK
1	Privacy Lock	21 PB	606	YR
1	Door Stop, base board	519	US4	RO
3	Silencer	609/608 appropriate to frame material		RO

Set: 3
Doors: U2, U3, U5, U6
Description: CLOSET / UTILITY PASSAGE

3	Hinge, Full Mortise	T2714 4" x 4"	US4	MK
1	Passage Latch	11 PB	606	YR
1	Door Stop, base board	519	US4	RO
3	Silencer	609/608 appropriate to frame material		RO

Set: 4
Doors: U8
Description: BI-PASSING CLOSET

1	Sliding Door Hdwe (BI-PASS)	HBP200A		PE
2	Flush Pull	872	US4	RO

Set: 5
Doors: U9
Description: PATIO ALL BY DOOR SUPPLIER.

1	Hardware By Others	Hardware By Door Supplier		

Set: 6
Doors: U11
Description: GARAGE

3	Hinge, Full Mortise	T2714 4" x 4"	US4	MK
1	Privacy Lock	21 PB	606	YR
1	Door Stop, base board	519	US4	RO
3	Silencer	609/608 appropriate to frame material		RO
1	Deadbolt			

Set: 7
Doors: U11
Description: BALCONY

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US4	MK
1	Privacy Lock	21 PB	606	YR
1	Surface Closer	1601	696	NO
1	Kick Plate	K1050 10" x 2" LDW 4BE CSK	US4	RO
1	Wall Stop	409	US4	RO
1	Frame Protection Pads	ACP112BL		PE
1	Door Bottom, concealed	434APKL		PE
1	Threshold	171G		PE
1	Gasketing	S88D		PE
1	Rain Guard	346G		PE
1	Deadbolt			

END OF SECTION 087100

SECTION 08 71 13.10 AUTOMATIC DOOR OPERATORS - RESIDENTIAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Residential Automatic Garage Door Operators.
   1. Belt drive garage door operators (LiftMaster Models 8155W).

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: For installation and requirements for blocking and nailers.

B. Section 16050 - Basic Electrical Materials and Methods: For installation and requirements for electrical connections.

1.3 REFERENCES

A. Underwriters Laboratories (UL) - UL Listed products.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Cleaning methods.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge conditions, and accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with labels intact until ready for installation.

B. Schedule delivery of garage door operator so that spaces are sufficiently complete that door operators can be installed immediately upon delivery.

1.6 WARRANTY

A. Manufacturer's Warranty. Provide manufacturer's standard warranty for each product. Refer to specific warranty information under each model in Part 2 of this section.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: LiftMaster; 300 Windsor Drive; Oak Brook, IL 60523. Toll-Free: 800.282.6225. Email: specs@LiftMaster.com Web: LiftMaster.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 BELT DRIVE GARAGE DOOR OPERATORS

A. Belt Drive Garage Door Operator: LiftMaster 8155W 1/2 HP AC Belt Drive Wi-Fi Garage Door Operator.
   1. Motor:
      a. Horsepower: 1/2.
      b. RPM: 1,625.
      c. Thermal Protection: Automatic.
      d. Lubrication: Permanent.
   2. Drive Mechanism:
      a. Drive Means: Full reinforced belt drive.
      b. Reduction Means: Gear 16:1.
      c. Door Linkage: Adjustable door arm.
   3. Logic Type: Solid-state microcontroller with built-in surge suppressor.
   4. Dimensions:
      a. Installed Length: 124 inches (3150 mm) for 7-foot (2133 mm) door opening.
      b. Maximum Door Opening: 7 feet 6 inches (2286 mm).
      c. Maximum Door Opening: Provide optional rail, 10 feet (3048 mm).
      d. Headroom Clearance Required: 2 inches (50.8 mm).
   5. Shipping Weight:
      a. Head: 21 pounds (9.5 kg).
      b. Rail: Belt 17 pounds (7.7 kg).
   6. Adjustments:
      a. Auto-Force.
      b. Electronic Limit Settings.
   7. Travel Rate:
      a. 7 inches (178 mm) per second.
   8. Electrical:
      a. Voltage: 120V AC, 60 Hz.
      b. Current Rating: 6.0A.
      c. UL Listed.
      d. Length of 3-Prong Line Cord: 4 feet (1219 mm).
   9. Security+ 2.0 Radio Controls:
      a. LiftMaster 893LM 3-Button Remote Control.
      b. Coding System: Smart Radio Receiver code button and indicator lights.
      c. Operating Range: 200 feet (61 m) (approximately).
      d. Operating Temperature: - 31 degrees F (-35 degrees C) to 149 degrees F (65 degrees C).
      e. Remote Control Radio Frequency: 310, 315 and 390 MHz tri-band.
      f. Radio Receiver Frequency: Radio Frequency agile on 310, 315 and 390 MHz.
      g. Security+ 2.0 anti-burglary coding.
   10. MyQ Powered Radio:
      a. 902 to 928 MHz.
      b. 50-channel FHSS (Frequency Hopping Spread Spectrum).
      c. Provides two-way communication from garage door operator and MyQ Accessories.
      d. Enables remote closing of garage door with key MyQ Accessories.
      e. Enables monitoring and control of garage door operators and lighting controls via Internet-enabled smartphone, tablet or computer (sold separately).

11. Security+ 2.0 Encrypted Controls:
    a. LiftMaster 882LMW Multi-Function Control Panel.
    b. Maintenance Alert System.
    c. Light Control: Turns operator lights on/off.
    d. Program remote controls, keypads and MyQ Accessories.
    e. Lock Mode: Locks out outside remote controls.
12. Lighting:
    a. Number of Bulbs: 1.
    b. Maximum Wattage: 100 x 1.
    c. Adjustable time, solid-state delay (1.5 to 4.5 minutes).
    d. Enhanced CFL (Compact Fluorescent) compatible.
13. Materials:
    a. Chassis: Steel.
    b. Chassis Cover: Steel/plastic.
    c. Rail: Solid steel T.
    d. Trolley: Steel.
14. Convenience/Safety Features:
    a. The Protector System safety reversing sensors.
    b. Alert-2-Close unattended close operation with select accessories (must not be used with one-piece door).
    c. Emergency/quick release.
    d. Automatic trolley reconnect.
    e. Ventilation/pet opening.
    f. Down safety reverse.
    g. Up safety stop.
    h. Door open/beam obstructed/lights on.
    i. PosiLock secure lock system.
15. Warranty:
    a. 4-year motor.
    b. 10-year belt.
    c. 1-year parts.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for interior doors, interior borrowed lites, and storefront framing
2. Glazing sealants and accessories.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 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 (300 mm) square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For 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.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.6 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 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. Subject to compliance with the criteria outlined in this specification the basis of design for Insulated glass units shall be PPG Solarban 60 clear glass on clear. Equal products will be considered when requested in writing to the Architect.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. 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. 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).
2. 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.
3. 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: Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. 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.

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.

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.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seals.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction

2.6 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 C920, Type S, Grade NS, Class 100/50, Use NT.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. Neoprene with a Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended by sealant or glass manufacturer.

C. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended by sealant or glass manufacturer.

D. Edge Blocks:

1. Neoprene with a Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended by sealant or glass manufacturer.

PART 3 - EXECUTION

3.1 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 (1270 mm).

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.

3.2 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.

3.3 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.

3.4 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.

3.5 MONOLITHIC GLASS SCHEDULE

A. Glass Type (1/4” interior): Clear annealed or fully tempered float glass.

1. Minimum Thickness: 6 mm
2. Safety glazing required.
3. Fire rated where required.

3.6 INSULATING GLASS SCHEDULE

A. Glass Type: Clear insulating glass.

1. Basis-of-Design Product: PPG Solarban 60

2. Overall Unit Thickness: 1 inch (25 mm)
3. Minimum Thickness of Each Glass Lite: 6 mm
4. Outdoor Lite: Annealed or Fully tempered float glass. (See drawings for tempered locations)
5. Interspace Content: Air.
6. Indoor Lite: Annealed or Fully tempered float glass. (See drawings for tempered locations)
7. Winter Nighttime U-Factor: 0.29 maximum.
8. Summer Daytime U-Factor: 0.31 maximum.
9. Solar Heat Gain Coeffiecient: 0.60 maximum
10. Safety glazing required.

END OF SECTION 088000

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each texture finish indicated on same backing indicated for Work.

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 E119 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 E90 and classified according to ASTM E413 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. Gypsum Wallboard: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C1396. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

E. Foil-Backed Gypsum Board: ASTM C1396.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

F. Impact-Resistant Gypsum Board: ASTM C1396 gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629, meets or exceeds Level 3 requirements.
4. Soft-Body Impact: ASTM C1629, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C1629, meets or exceeds Level 3 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

G. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396, with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178, with manufacturer's standard edges.

1. Core**:** 5/8 inch, Type X.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
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.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. 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 setting-type, sandable topping 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.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, 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.

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.

D. 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.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated on drawings.
2. Level 2: Panels that are substrate for tile and acoustical tile or where indicated on drawings.
3. Level 3: Where indicated on drawings.
4. Level 4: At all panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

5. Level 5: Where indicated on drawings.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

H. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

I. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

J. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 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, and mold damaged.

END OF SECTION 092900

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior and the following exterior substrates:

1. Gypsum and fiberglass-mat gypsum boards.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of paint system and each color and gloss of topcoat.

1.4 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. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Benjamin Moore
2. Sherwin-Williams
3. Or approved equal

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. 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.

C. Colors: As selected by Architect from manufacturer's full range or as indicated in drawings.

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. Concrete: 12 percent.
2. Masonry (CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. 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.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. 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.

3.4 CLEANING AND PROTECTION

A. 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.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

    a. Prime Coat: Primer, alkali resistant, water based.
    b. Prime Coat: Latex, exterior, matching topcoat.
    c. Intermediate Coat: Latex, exterior, matching topcoat.
    d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).

2. High-Build Latex System: Dry film thickness of not less than 10 mils.

    a. Prime Coat: As recommended in writing by topcoat manufacturer.
    b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    c. Topcoat: Latex, exterior, high build.

B. Cement Board Substrates:

1. Latex System:

    a. Prime Coat: Latex, exterior, matching topcoat.
    b. Prime Coat: Primer, alkali resistant, water based.
    c. Intermediate Coat: Latex, exterior, matching topcoat.
    d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).

2. High-Build Latex System: Dry film thickness of not less than 10 mils.

    a. Prime Coat: As recommended in writing by topcoat manufacturer.
    b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    c. Topcoat: Latex, exterior, high build.

C. Exterior Gypsum Board Substrates:

1. Latex System:

    a. Prime Coat: Primer, latex for exterior wood (reduced).
    b. Intermediate Coat: Latex, exterior, matching topcoat.
    c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1).

2. Alkyd System:

    a. Prime Coat: Primer, latex for exterior wood (reduced).
    b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
    c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1).

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior and the following interior substrates:

1. Gypsum board.
2. Wall base

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1.4 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. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Benjamin Moore
2. Sherwin Williams
3. Or approved equal

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. 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.

C. Colors: As selected by Architect from manufacturer's full range or as indicated in the drawings.

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. Concrete: 12 percent.
2. Masonry (CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. 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.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. 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.

3.4 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

    a. Prime Coat: Primer, alkali resistant, water based.
    b. Prime Coat: Latex, interior, matching topcoat.
    c. Intermediate Coat: Latex, interior, matching topcoat.
    d. Topcoat: Latex, interior (MPI Gloss Level 2-3).

2. Institutional Low-Odor/VOC Latex System:

    a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2-3).

3. Alkyd System:

    a. Prime Coat: Primer, alkali resistant, water based.
    b. Intermediate Coat: Alkyd, interior, matching topcoat.
    c. Topcoat: Alkyd, interior (MPI Gloss Level 2-3).

B. Gypsum Board Substrates:

1. Latex over Latex Sealer System:

    a. Prime Coat: Primer sealer, latex, interior.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior (MPI Gloss Level 2).

2. Institutional Low-Odor/VOC Latex System:

    a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOCt (MPI Gloss Level 2).

3. Alkyd over Latex Sealer System:

    a. Prime Coat: Primer sealer, latex, interior.
    b. Intermediate Coat: Alkyd, interior, matching topcoat.
    c. Topcoat: Alkyd, interior (MPI Gloss Level 2).

END OF SECTION 099123

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated A:B:C, 5 lbs nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or **red** baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. All contract documents including drawings, alternates, addenda, and modifications in addition to this specification are applicable to the Plumbing Contractor (P/C) and his Subcontractors, and material suppliers.

B. Engineer, wherever used in the specifications, shall mean Latimer Sommers & Associates, P.A., 3639 S.W. Summerfield Dr., Topeka, KS 66614, 785-233-3232, lsapa@lsapa.com.

C. Contractor, wherever used in these specifications, shall mean the company that enters into contract with the General Contractor or Owner to perform this section of work.

D. When a word such as “proper”, “satisfactory”’ “equivalent”, and “as directed”, is used, it requires Engineer’s review. “Provide” means furnish, install, and commission.

E. Changes or deviations from the contract, including those for additional work, must be submitted in writing for review by the Engineer.

F. If conflicts or ambiguities are present between the drawings and specifications, the contractor shall contact the Engineer for clarification. If no resolution is made by the Engineer via an addendum, the more costly option shall be included in the contract. Contractor shall notify Engineer as soon as possible for a resolution.

G. Do not scale plumbing drawings for dimensions. Accurately lay-out work from dimensions indicated on Architectural drawings unless such is found in error.

H. Items not shown on the drawings or in the specifications, but reasonably inferred from the documents shall be included in the contract.

I. Contractor may be allowed access to the CAD drawings files produced by the Engineer upon written release and payment of charges.

1.2 LOCATIONS AND INTERFERENCES

A. Contractor shall visit site to determine existing site conditions that affect the contracted work.

B. Locations of equipment, piping and other mechanical work are indicated diagrammatically by the drawings. Determine exact locations on site, subject to structural conditions, work of other Contractors, access requirements for installation and maintenance to the approval of the Engineer.

C. Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for installation. Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Engineer. Failure of contractor to coordinate with other trades prior to construction is not cause for additional compensation.

D. Any pipe, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the project. These organizations shall come to the site and provide acceptable service to restore operations within 24 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 48 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
5. Asbestos products or equipment or materials containing asbestos shall not be used.
6. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

B. Warranty

1. Contractor warrants to Owner and Architect the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.
2. Contractor warrants to Owner and Architect that on receipt of written notice from either of them within one-year warranty period following date of acceptance that defects have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
3. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, install equipment or accessories per these instructions including all items needed to fulfill these requirements. Any discrepancy between these instructions, Code, and the contract documents shall be brought to the attention of the Engineer for interpretation. Installation shall meet manufacturer's recommended clearances. Any conflicts shall be brought to the attention of the Engineer prior to installation.

D. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

1.4 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS

A. The intent of these specifications is to allow competition in bidding on standards of materials and equipment required.

B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage unless shown otherwise on the drawings.

C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product may be used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

E. Prior to receipt of bids, if contractor wishes to incorporate products other than those named in specifications in his base bid, he shall submit a written request for review of substitutions to Engineer not less than five working days prior to bid time. Engineer

may review requests and acceptable items will be listed in an addendum issued to principal bidders.

F. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison. Differences between specified and submitted items shall be listed by the supplier/contractor and included with the submittal.

G. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical electrical service requirements necessary to accommodate such substitution; whether such affected elements to this contract or under separate contracts.

1.5 SUBMITTALS

A. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Information shall be clearly marked as to individual model to be provided on this project. Do not submit operations manuals, installation guides, wiring diagrams, or other voluminous documents unless requested by Engineer. If the Contractor feels these items are pertinent in the review, prior approval shall be obtained from the Engineer. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been reviewed, no change in brand or make will be permitted unless approved by the Engineer.

B. Engineer may review submittals only as a courtesy to the contractor. Contractor has the obligation to provide items/work in the contract documents or reasonably inferred and this includes the project schedule. The lack of comments, notes, or other indications made by the Engineer on a submittal does not relieve the contractor from providing the necessary items/work. Review by the Engineer does not constitute “approval” of items submitted. Engineer will not check quantities, dimensions, etc. for accuracy or appropriateness.

C. Forward submittals in sufficient time to permit proper consideration by the Engineer. Provide submission to assure adequate lead time for procurement. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion. Engineer shall endeavor to review submittals in two weeks.

D. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor and shall contain the list of items, name of project, name of Contractor, supplier and their contact numbers, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of

location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, submittals shall be marked to indicate specific items submitted for approval. Submittal shall bear the General and Sub-Contractor's approval stamp indicating they have reviewed the submittal for conformance to the contract documents.

E. Where required by these specifications, the drawings, or the Engineer, provide scaled shop drawings of the piping systems and/or equipment to reflect actual routing, location, coordination with other trades and structure, and maintenance accessibility. Review with Engineer scope of the documents prior to submission.

F. Upon request of the Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.6 OPERATIONS AND MAINTENANCE MANUALS

A. Submit two copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Instructions shall be prepared by equipment manufacturer.

B. Present to Owner, keys and wrenches furnished with equipment under this contract and obtain receipt for same upon completion of project.

C. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Provide brochures bound in three-ring binders with metal hinge. Clearly print project and section covered on label insert of each brochure. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked.
2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
3. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
4. A complete set of as-built drawings to scale showing all mechanical systems as installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for

the protection of such equipment and material against any damage. This shall include any existing, relocated or owner-furnished equipment/systems.
2. Place damaged equipment in first class, new operating condition; or replace same as determined and directed by the Engineer. Such repair or replacement shall be at no additional cost to the Owner.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before installing or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or cleaned as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.8 SAFETY AND SECURITY

A. Contractor shall follow OSHA safety regulations while on site and have an OSHA-trained individual on site at all times.

B. Contractor shall follow Owner’s safety and security regulations with regards to identification, keys and access, document control, motor vehicles, firearms, illegal substances, smoking, etc as per the Owner’s request.

C. Contractor shall follow fire safety rules per OSHA and NFPA standards regarding temporary facilities, maintaining fire exiting, fire suppression and alarm systems, hot work, storage, utilities, etc.

1.9 DISPOSAL AND RETENTION

A. Waste materials, including those considered hazardous, accrued from the construction process shall be removed promptly from the project site in a manner approved by the authorities having jurisdiction.

B. Verify with the owner any items that may be retained by the owner for future use or salvage prior to removal.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

B. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

C. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 SAFETY GUARDS

A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with adequate bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.4 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods shall conform to the requirements of other sections of this specification. Provide all electrical wiring, conduit,

and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the owner.
2. Assemblies of motors, starters, controls, and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers or heaters.
   b. Other wiring at boilers or heaters and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements generally defined by motor manufacturers as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as “high efficiency” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.6 ELECTRICAL REQUIREMENTS

A. Electrical work required to install and control plumbing equipment which is not shown on plans or specified under sections in series 26000 shall be included in P/C's base bid proposal.

B. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design shall be paid for by P/C at no cost to Owner or A/E.

C. P/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

D. P/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

E. Furnish complete sets of electrical wiring diagrams to A/E and to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.

F. Safety disconnect switches and manual and magnetic motor starters shall be provided by the P/C where not provided by the E/C per the drawings.

2.7 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.

B. Equipment: Engraved phenolic nameplates, with letters not less than 48 mm (3/16-inch) high with white-filled letters permanently fastened to the non-apartment unit equipment.

C. Valve Tags and Lists:

1. Plumbing: Provide for all valves (Fixture stops not included) in non-apartment applications.
2. Valve tags: Engraved black filled numbers and letters not less than 1/2 -inch high for number designation, and not less than 1/4-inch for service designation, 1-1/2 inches round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated 8 ½ x 11 card(s) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve.

2.8 FIRESTOPPING

A. Provide an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping with a U.L. listed firestop material and in a U.L. listed assembly configuration. Submit material and assembly detail for review.

2.9 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Lubricants: A minimum of one quart of oil, and one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.
C. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed.
2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by A/E.
3. Do not penetrate membrane waterproofing.

D. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown, but must be provided.

E. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

F. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Engineer. Damaged or defective items in the opinion of the t Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury.

G. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.

H. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

I. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

J. Inaccessible Equipment:

1. Where the A/E determines that the P/C has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

D. All temporary shut-downs of service shall be coordinated with the owner and other trades as needed to maintain operating service in the facility. Off-hours work is normally needed to accomplish these and shall be included in the contract.

3.3 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by P/C and will be considered by A/E under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for operation and maintenance of service.

D. P/C shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

3.4 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, equipment and systems shall be thoroughly cleaned and painted.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material and equipment not to be painted includes:
    a. Motors, controllers, control switches, and safety switches.
    b. Control and interlock devices.
    c. Regulators.
    d. Pressure reducing valves.
    e. Control valves and thermostatic elements.
    f. Lubrication devices and grease fittings.
    g. Copper, brass, aluminum, stainless steel and bronze surfaces.
    h. Valve stems and rotating shafts.
    i. Pressure gauges and thermometers.
    j. Glass.
    k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
6. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 STARTUP AND TEMPORARY OPERATION

A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION 22500

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SECTION 220700 - PIPING AND EQUIPMENT INSULATION

PART 1 - GENERAL (Reference Section 15010)

1.1 GENERAL REQUIREMENTS

A. Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.

B. Provide insulation materials manufactured by Armstrong Cork Co. Certain/Teed Saint Gobain, Dow Chemical, Schuller or Owen-Corning Fiberglass.

C. Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as rested by ASTM E-84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

Provide insulation accessories such as adhesives, mastics, cements, tape and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

D. Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips or fitting covers.

E. Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

F. Insulation of removable heads, manholes access covers, etc., shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

G. Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season,

whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS AND APPLICATION METHODS (PIPING)

A. Pipe insulation by type shall be as follows:

1. Type 1-PC: Insulation for cold surface equipment insulation for external surfaces with +40 degrees F to +220 degrees F operating temperature range shall be Armstrong FR/Armaflex pipe or sheet insulation as required with 5.5" or 6.0 lb. density. Average thermal conductivity shall not exceed .27 BTU/HR at 75 F mean temperature. Apply insulation directly to metal surfaces and seal insulation joints with Armstrong No. 520. Insulation shall be mitered, beveled and built-up as required to provide a smooth and neat exterior surface. Insulate these joint areas so that insulation can be easily removed from casing joints without removing or damaging adjacent insulation.

2. TYPE 1-PHC: Insulation for hot and cold surface piping systems with +40 degrees F to +450 degrees F operating range shall be Owens-Corning Fiberglass 25, 4.0 lb. density pipe insulation with white fire retardant ASJ jacket. Average thermal conductivity shall not exceed .26 BTU/Hr. at 75 degrees F mean temperature. Seal longitudinal jacket laps and butt strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:
   a. Insulate exposed and concealed valves and fittings with 2" thick glass fiberglass inserts or blankets. Cover fittings with Zeston Products PVC fitting covers or approved equal. PVC fitting covers shall be secured with mechanical fasteners such as tacks or staples for temperatures above 75 degrees F. For cold service all joints shall be sealed with vapor barrier adhesive or by pressure sensitive vapor barrier vinyl tape.

2.2 INSULATION MATERIALS AND APPLICATION METHODS (HANGERS, SUPPORTS, ANCHORS, GUIDES, EXPANSION JOINTS, ETC.)

A. Insulation materials and application methods for piping hangers supports, anchors, guides expansion joints, etc., shall be as follows:

1. Insulate hangers and supports from direct contact with 3" and above piping with Styrofoam HD-300 plastic foam inserts of half or full sections. Provide inserts with vapor barrier jacket for lapping 2" over adjoining insulation. Insert jacket shall be equal in performance and appearance to adjacent pipe insulation jacket. On 1-1/4" to 2-1/2" piping protect insulation with properly sized wood dowels cut within insulation. 1" pipe and below needs no inserts. Seal joints with vapor barrier sealer specified for insulation type used.
2. Where piping hanger cannot be isolated from cold pipe surfaces insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to point

12" above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer for insulation type used.

2.3 PIPE AND VALVE INSULATION SCHEDULE

SYSTEM	SIZE	TYPE	THICKNESS
HW below slab	All	1-PHC	½”

Note: No piping shall be located in attics or other unconditioned areas.

END OF SECTION 220700

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SECTION 221100 - PLUMBING PIPING, EQUIPMENT AND ACCESSORIES

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 PIPING MATERIALS AND FITTINGS

A. Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturers name and weight. All materials listed may not be required on this project. Piping materials shall be as follows:

1. Copper Tube:
   a. Provide hard temper copper water tube conforming to requirements of current ASTM Specification B-88. Tubing shall be Type K, L, or M as listed in schedule.
   b. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.
   c. Pipe by Anaconda, Cerro, Chase, Mueller or Revere Copper.
2. PVC Pipe:
   a. Below grade/exterior pipe and fittings shall be ABS solid wall pipe extra strength conforming to ASTM D2661, F628
   b. Below slab pipe and fittings shall be PVC-DWV conforming to ASTM D-2665.
   c. Above grade pipe and fittings shall meet schedule 40 PVC ASTM D-2665 standards or cellular core PVC conforming to ASTM F1488. Provide cast iron where in the ceiling areas of the commercial or amenity areas..
   d. Provide socket fittings meeting ASTM D2665 and solvent meeting D2564.
3. Cross-Linked Polyethylene:
   a. Provide piping conforming to ASTM F 877-97 and F877-96a with compression fittings per ASTM F 1807-97.
4. Carbon Steel Pipe (1/2" thru 2"):
   a. Provide seamless carbon steel conforming to ASTM specification A-106 scheduled.
   b. Pipe joints shall be threaded conforming to ANSI Standard B2.1.
   c. Pipe ends shall be beveled for welding.
   d. Pipe by Armco, Jones and Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.
5. Carbon Steel Pipe (2-1/2" and above):
   a. Provide furnace butt-welded carbon steel pipe conforming to ASTM Specification A-53.
   b. Pipe ends shall be beveled for welding.
   c. Pipe by Armco, Jones and Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.
6. CPVC Pipe:
   a. Provide CPVC plastic pipe and tubing meeting ASTM D2846, F441 for 2” and below.

b. For 2 ½" and larger provide CPVC (Corzan) Sc. 40 meeting ASTM D- 1784.
c. Fittings shall be matching CPVC meeting ASTM F437, 438.

2.2 PIPE SCHEDULE

SYSTEM	SIZE	TYPE	FITTINGS	DURATION
Condensate Drain	All	Sch. 40 PVC	PVC-DWV	---
Dom. Water	<2"	PEX/CPVC	Compression	150 psi/1 hr.
Dom. Water	2" and Above	CPVC-Sch 40	Solvent	150 psi/1 hr
Waste/Vent	All	Sch. 40 PVC	PVC-DWV	10 ft./1/2 hr.
Refrigerant	All	Copper	Silver solder	400 psi/1hr

2.3 VALVES

A. General

1. Provide necessary valves within piping systems to provide required flow control and to allow isolation for inspection, maintenance and repair of each piece of equipment or fixture, and on each main and branch service loop.
2. Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.
3. Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance.
4. Equivalent valves listed on current comparison charts of specified valve manufacturers by Apollo, Crane, Nibco, Dyna Quip, Keystone, Milwaukee, Griswold, Nexus are acceptable.

B. Ball Valves

1. Ball valves shall be scheduled as type "BLV" valves. Valve specifications by type number shall be as follows:

BLV-1 2-1/2" valves and smaller, Apollo bronze full port ball valve 150PSI-SWP, teflon seats, chrome plated ball, blowout proof stem, silicon bronze stem, with end connections compatible to PEX or CPVC as per application.

C. Balancing Valves

1. Balancing valves shall be scheduled as Type "BAV" valves. All balancing valves may be installed on the return or supply side of coils and shall be line sized. Provide proper sized valves for the specified flows. Provide strainers at all valves. Valve specification by type number shall be as follows:
BAV-1 3/4" thru 2 1/2": Flow Design Inc. model AC automatic type of forged brass with ball valve, flow cartridge, 400 PSIG at 250oF rating and sweat or screw connections as required.

D. Check Valves

1. Silent check valves shall be scheduled as Type "SCV" valves. Valve specifications by type number shall be as follows:

   SCV-1 2" valves and smaller Stockham Fig. No. B-310T or B-320T bronze check valve, 125 PSI-WOG, spring, brass stem, teflon disc and seat ring, screwed or solder ends as required.

   SCV-2 2-1/2" and larger Muessco #101-DT iron body stainless steel trim check valve 150 PSI-ASA with flanged ends.

E. Butterfly Valves

1. Butterfly valves shall be scheduled as Type "BFV" valves. Valve specifications by type number shall be as follows:

   BFV-1 3" thru 6", Nibco #LD-200, 200 PSI ductile iron drilled lug body, lever operator aluminum/bronze disc, type 416 stainless steel stem and EPDM sleeve valve shall be bubble tight and designed for dead end service.

F. Valve Schedule

SYSTEM	SIZE	STOP	CHECK	BALANCE
Domestic Water	1/2"-2"	BLV-1	SCV-1	BAV-1

2.4 PIPE SLEEVES AND SEALS

A. Furnish proper type and size pipe sleeves to General Contractor for installation in concrete or masonry walls or floors. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab or grade except where penetrating a membrane waterproof floor. Mechanical Contractor shall supervise installation of sleeves to insure proper location and installation.

B. Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved.

C. Pipe insulation shall run continuous through pipe sleeves with 1/4" minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 3/8" wide band. Seal annular space between jacket and pipe sleeves with Thunderline High Temperature Link Seal.

D. Provide pipes passing through roof of floor waterproof membranes with flashing sleeve. Seal pipe to sleeve with fire caulk.

E. Where piping passes through walls serving as supply or exhaust air plenums or chases, seal annular space between pipe and sleeve air tight with caulk; fire rated if appropriate.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide and be responsible for locations of piping hangers, supports and inserts, etc., required for installation of piping under this contract. Design of hangers and supports shall conform to industry standard, manufacturer's recommendations and City Code. Contractor to submit.

B. Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight induced into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.

C. Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments to that rod is vertical in hot position. Hangers shall not become disengaged by movements of supported pipe.

D. Provide sufficient hangers to adequately support piping system at specified spacing, at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustment to maintain pitch required for proper drainage, and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.

E. Hangers in direct contact with copper pipe or tubing shall be copper plated.

F. Unless indicated otherwise on drawings or in manufacturer's literature, support horizontal piping as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	3/8"	6 Ft.
1-1/4" to 1-1/2"	3/8"	8 Ft.
2"	3/8"	9 Ft.

G. Provide continuous threaded hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subject to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe supports indicating pipe sizes, service and support detail to Architect/Engineer for review prior to fabrication.

H. Provide Grinnell Fig. 194, 195, or 199 steel wall brackets for piping suspended or supported from walls. Brackets shall be prime coated carbon steel.

I. Mount hangers for insulated piping on outside of pipe insulation sized to allow for full thickness of pipe insulation. Provide Grinnell Fig. 167 insulation protection shields sized

so that line compressive load does not exceed one-third of insulation compressive strength. Shield shall be galvanized steel and support lower 180 degrees of pipe insulation on copper tubing.

J. Structural attachments for pipe hangers shall be as follows:

1. Concrete Structure: Provide Grinnell Fig. No. 285 concrete insert for loads up to 400 lbs. and Grinnell Fig. 281 wedge type concrete insert for loads up to 1200 lbs.
2. Steel Beam Structure: Provide Grinnell Fig. No. 86 malleable iron C-clamp for pipe size 2" and smaller and Grinnell Fig. 229 malleable iron beam clamp for pipe size 2-1/2" and larger.

K. Equivalent hangers and supports by Auto-Grip, Basic Engineer, Elcen, Fee & Mason, Fluorcarbon Company, Unistrut or Super Strut Inc., B-Line.

2.6 CONCRETE INSERTS AND ANCHORS

A. In new construction where attachment points can be predetermined provide Fee & Mason Fig. 9000 continuous concrete insert of Fig. 186 Universal Steel concrete insert.

B. Equivalent by B-Line.

2.7 CLEANOUTS

A. Provide cleanout the full size of soil pipe served up to 4" I.D. Cleanouts for soil lines larger than 4" shall be 4". Provide cleanouts in base of soil pipe stacks, ends of sewer main, at changes in direction of over 45 degrees and in horizontal pipe runs exceeding 100 feet at 50 foot intervals.

B. Install cleanouts so they are accessible by extending them through walls, floors, to outside of building or to above grade as required.

C. Where exterior cleanouts do not occur in sidewalks, paved roadways, etc., provide a concrete pad with top 1-1/2" above finished grade, see detail on drawings.

For Clubhouse / Commons Areas:

1. Floor (Concrete Floor Finish): Zurn #ZN 1405-3 "Supremo Level-Trol Tuf-Top" dura-coated iron cleanout with square, heavy duty, scoriated Zurn nickel bronze with adjustable above to finished floor.
2. Floor (Quarry Tile Floor Finish): Same as concrete floor finish.
3. Floor (Tile Floor Finish): Zurn #ZN-1405.7 "Supremo-Level-Trol-Tuf-Top" dura-coated cast iron cleanout with square heavy duty Zurn nickel bronze top, recessed for tile and adjustable to finished floor.
4. Floor (Carpet Floor Finish): Zurn #ZN-1405.14" "Supremo-Level-Trol-Tuf Top" dura-coated cast iron cleanout with round, heavy duty Zurn nickel bronze top with carpet retainer and adjustable to finished floor after concrete has set.

5. Wall: Zurn ZN-1440.4 "Supremo" cleanout with dura-coated cast iron ferrule and cadmium plated cast iron counter-sunk plug complete with square smooth Zurn nickel bronze wall access cover and flush over-wall frame.
6. Yard: Zurn Z-1460-15 round dura-coated cast iron cleanout housing with integral seepage pan. Housing shall be complete with secured scoriated cover with lifting device.

For Apartments:
1. Provide adjustable ABS/PVC body unit with nickel bronze cover, Sioux Chief #852 series.

D. Verify floor materials used from Architectural plans and provide proper cleanout tops, where they occur in carpet, quarry tile, vinyl tile or ceramic tile.

E. Equivalent cleanout by Sioux Chief, J.R. Smith, Wade, Ancon or Josam.

2.8 SHOCK ARRESTORS

A. Provide Zurn Z-1700 bellows type water hammer arrestor on all banks shown sized for manufacturer's recommendations.

B. Install with shut-off in accessible location.

C. Equivalent by Josam, Smith, Wade, Amtrol.

2.9 FLOOR DRAINS

A. Unless otherwise noted, provide each drain with deep seal P-trap at the drain.

B. See schedule on drawings.

2.10 WALL HYDRANT

A. Woodford #17 anti-siphon auto draining exposed unit with cast bronze face, key operation, all bronze parts.

B. Equivalent by Wade, Smith, Josam.

2.11 BACKFLOW PREVENTERS

A. Where shown and where required by code, provide Watts 709-S-QT or 909-S-QT device with strainer and ball valve isolators.

B. Equivalent by Febco, ITT, Zurn.

2.12 WATER HEATERS

A. See drawings. Equivalent by Bradford White, American, State, Rheem.

2.13 DOWNSPOUT NOZZLE

A. Zurn #ZANB-199 nickel bronze body, threaded inlet, decorative wall flange and nozzle.

B. Equivalent by Wade, Josam, Smith, Sioux Chief.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Piping systems materials and installation shall conform to the latest standards and codes. Mechanical contractor shall take full responsibility for the final selection, installation and integrity of the piping support system.

B. Pipe sizes indicated on plans and as specified refer to nominal size in inches for steel pipe, cast iron pipe and copper tubing, unless otherwise indicated. Pipes are sized to nearest 1/2". In no case shall piping smaller than size specified be used.

C. Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc., as recommended by manufacturer and as specified and detailed on drawings. Verify construction types and provide proper hangers, inserts and supports for construction used. Install inserts, hangers and supports in accordance with manufacturers load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports.

D. Install piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping system. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves and fittings used are not exceeded during normal operation or testing of piping system.

E. Install piping so that systems can be completely drained. Provide piping systems with valve drain connections at all low pipe and ahead of all sectionalizing valves whether shown on plans or not.

END OF SECTION 221100

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SECTION 230500 - COMMON WORK RESULTS FOR MECHANICAL SYSTEM

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. All contract documents including drawings, alternates, addenda, and modifications in addition to this specification are applicable to the MECHANICAL Contractor (M/C) and his Subcontractors, and material suppliers.

B. Engineer, wherever used in the specifications, shall mean Latimer Sommers & Associates, P.A., 3639 S.W. Summerfield Dr., Topeka, KS 66614, 785-233-3232, lsapa@lsapa.com.

C. Contractor, wherever used in these specifications, shall mean the company that enters into contract with the General Contractor or Owner to perform this section of work.

D. When a word such as “proper”, “satisfactory”’ “equivalent”, and “as directed”, is used, it requires Engineer’s review. “Provide” means furnish, install, and commission.

E. Changes or deviations from the contract, including those for additional work, must be submitted in writing for review by the Engineer.

F. If conflicts or ambiguities are present between the drawings and specifications, the contractor shall contact the Engineer for clarification. If no resolution is made by the Engineer via an addendum, the more costly option shall be included in the contract. Contractor shall notify Engineer as soon as possible for a resolution.

G. Do not scale MECHANICAL drawings for dimensions. Accurately lay-out work from dimensions indicated on Architectural drawings unless such is found in error.

H. Items not shown on the drawings or in the specifications, but reasonably inferred from the documents shall be included in the contract.

I. Contractor may be allowed access to the CAD drawings files produced by the Engineer upon written release and payment of charges.

1.2 LOCATIONS AND INTERFERENCES

A. Contractor shall visit site to determine existing site conditions that affect the contracted work.

B. Locations of equipment, piping and other mechanical work are indicated diagrammatically by the drawings. Determine exact locations on site, subject to structural conditions, work of other Contractors, access requirements for installation and maintenance to the approval of the Engineer.

C. Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for installation. Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Engineer. Failure of contractor to coordinate with other trades prior to construction is not cause for additional compensation.

D. Any pipe, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
5. Asbestos products or equipment or materials containing asbestos shall not be used.
6. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

B. Warranty

1. Contractor warrants to Owner and Architect the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.
2. Contractor warrants to Owner and Architect that on receipt of written notice from either of them within one year warranty period following date of acceptance that defects have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
3. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, install equipment or accessories per these instructions including all items needed to fulfill these requirements. Any discrepancy between these instructions, Code, and the contract documents shall be brought to the attention of the Engineer for interpretation. Installation shall meet manufacturer’s recommended clearances. Any conflicts shall be brought to the attention of the Engineer prior to installation.

D. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

1.4 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS

A. The intent of these specifications is to allow competition in bidding on standards of materials and equipment required. Material and equipment installed under this contract shall be first class quality, new, unused and without damage unless shown otherwise on the drawings.

B. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product may be used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

C. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

D. Prior to receipt of bids, if contractor wishes to incorporate products other than those named in specifications in his base bid, he shall submit a written request for review of substitutions to Engineer not less than five working days prior to bid time. Engineer may review requests and acceptable items will be listed in an addendum issued to principal bidders.

E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison. Differences between specified and submitted items shall be listed by the supplier/contractor and included with the submittal.

F. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical electrical service requirements necessary to accommodate such substitution; whether such affected elements to this contract or under separate contracts.

1.5 SUBMITTALS

A. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Information shall be clearly marked as to individual model to be provided on this project. Do not submit operations manuals, installation guides, wiring diagrams, or other voluminous documents unless requested by Engineer. If the Contractor feels these items are pertinent in the review, prior approval shall be obtained from the Engineer. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been reviewed, no change in brand or make will be permitted unless approved by the Engineer.

B. Engineer may review submittals only as a courtesy to the contractor. Contractor has the obligation to provide items/work in the contract documents or reasonably inferred. The lack of comments, notes, or other indications made by the Engineer on a submittal does not relieve the contractor from providing the necessary items/work. Review by the Engineer does not constitute “approval” of items submitted. Engineer will not check quantities, dimensions, etc. for accuracy or appropriateness.

C. Forward submittals in sufficient time to permit proper consideration by the Engineer. Provide submission to assure adequate lead time for procurement. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion. Engineer shall endeavor to review submittals in two weeks.

D. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor and shall contain the list of items, name of project, name of Contractor, supplier and their contact numbers, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, submittals shall be marked to indicate specific items submitted for approval. Submittal shall bear the Contractor’s approval

stamp indicating they have reviewed the submittal for conformance to the contract documents.

E. Where required by these specifications, the drawings, or the Engineer, provide scaled shop drawings of the piping systems and/or equipment to reflect actual routing, location, coordination with other trades and structure, and maintenance accessibility. Review with Engineer scope of the documents prior to submission.

F. Upon request of the Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.6 OPERATIONS AND MAINTENANCE MANUALS

A. Submit two copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Instructions shall be prepared by equipment manufacturer.

B. Present to Owner, keys and wrenches furnished with equipment under this contract and obtain receipt for same upon completion of project.

C. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Provide brochures bound in three-ring binders with metal hinge. Clearly print project and section covered on label insert of each brochure. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked.
2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
3. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
4. A complete set of as-built drawings to scale showing all mechanical systems as installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage. This shall include any existing, relocated or owner-furnished equipment/systems.
2. Place damaged equipment in first class, new operating condition; or replace same as determined and directed by the Engineer. Such repair or replacement shall be at no additional cost to the Owner.

3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before installing or placing equipment in operation.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or cleaned as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.8 SAFETY AND SECURITY

A. Visits to the site shall be pre-arranged through the Owner's representative.

B. Contractor shall follow OSHA safety regulations while on site and have an OSHA-trained individual on site at all times.

C. Contractor shall follow Owner's safety and security regulations with regards to identification, keys and access, document control, motor vehicles, firearms, illegal substances, smoking, etc as per the Owner's request.

D. Contractor shall follow fire safety rules per OSHA and NFPA standards regarding temporary facilities, maintaining fire exiting, fire suppression and alarm systems, hot work, storage, utilities, etc.

1.9 DISPOSAL AND RETENTION

A. Waste materials, including those considered hazardous, accrued from the construction process shall be removed promptly from the project site in a manner approved by the authorities having jurisdiction.

B. Verify with the owner any items that may be retained by the owner for future use or salvage prior to removal.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.

2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

B. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

C. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.4 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods shall conform to the requirements of other sections of this specification. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the owner.
2. Assemblies of motors, starters, controls, and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers or heaters.
b. Other wiring at boilers or heaters and to control panels shall be NFPA 70 designation THWN.
c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements generally defined by motor manufacturers as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as “high efficiency” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.5 ELECTRICAL REQUIREMENTS

A. Electrical work required to install and control MECHANICAL equipment which is not shown on plans or specified under sections in series 26000 shall be included in M/C's base bid proposal.

B. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design shall be paid for by M/C at no cost to Owner or A/E.

C. M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

D. M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

E. Furnish complete sets of electrical wiring diagrams to A/E and to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.

F. Safety disconnect switches and manual and magnetic motor starters shall be provided by the M/C where not provided by the E/C per the drawings.

2.6 FIRESTOPPING

A. Provide an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping with a U.L. listed firestop material and in a U.L. listed assembly configuration. Submit material and assembly detail for review.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed.
2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by A/E.
3. Do not penetrate membrane waterproofing.

D. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

E. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

F. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum.

G. Inaccessible Equipment:

1. Where the A/E determines that the M/C has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

B. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

C. All temporary shut-downs of service shall be coordinated with the owner and other trades as needed to maintain operating service in the facility. Off-hours work is normally needed to accomplish these and shall be included in the contract.

3.3 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the facility for beneficial use by the Owner, equipment and systems shall be thoroughly cleaned and touch-up painted if damaged.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material And Equipment Not To Be Painted Includes:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.4 STARTUP AND TEMPORARY OPERATION

A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION 230500

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SECTION 230593 - TESTING & BALANCING

PART 1 – GENERAL

1.1 TESTING AND BALANCING

A. Testing and balancing of the building air and water systems will be to be completed near the end of construction. The Mechanical Contractor has responsibility to cooperate with, make adjustments for, and provide any equipment necessary for the TAB agency to complete the job.

1.2 ACCEPTABLE TESTING AND BALANCING FIRMS:

A. Firm shall be third party, NEBB or AABC certified. Submit qualifications, references and a project list of similar size and scope to Engineer for approval.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SYSTEM PREPARATION FOR TESTING AND BALANCING

A. Prior to requesting testing and balancing agency to perform their work the installing contractor shall make all necessary inspections and adjustments to ensure that systems are completely installed and operating in accordance with the manufacturer's recommendations and the contract documents.

B. The following checks shall be performed on each system installed under this contract. A report sheet shall be prepared for each system indicating checks made, corrective action taken where required, date, and name of person making inspection. Submit one copy to testing and balancing agency and two to A/E. Testing and balancing agency will not begin until checklist has been received and reviewed.

1. Air Handling Systems:

a. Clear system of all foreign objects and clean system.
b. Verify fan rotation.
c. Check bearing condition and lubrication.
d. Check fan wheel clearances and fan alignment.
e. Check motor security to mounting base.
f. Check alignment of drive.
g. Check vibration isolator adjustment.
h. Verify that proper filter media is installed.
i. Verify that all control dampers are installed and operable without binding or sticking.
j. Confirm that all fire, smoke and volume dampers are installed and in full open position.

k. Verify that all air terminal units are installed.
l. Confirm that all air openings in walls above ceilings have been provided.
m. Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils.
n. Air leaks shall not exceed SMACNA parameters for system pressure.
o. Verify that ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.

3.2 AIR BALANCE

A. The Subcontractor shall procure the services of the independent air balance and testing agency, approved by the Engineer, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution and exhaust systems. 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 within six months of performing work and maintained in good working order. If requested the tests shall be conducted in the presence of the Engineer responsible for the project and/or its representative. The testing and balancing firm shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.

B. Air balance and testing shall not begin until systems have been completed and are in full working order. All heating, ventilation, and air conditioning systems and equipment shall be in full operation during each working day of testing and balancing.

C. The Subcontractor shall make changes in pulleys, belts, dampers, etc., as required by the test and balance agency, at no additional cost to the Owner.

D. The Subcontractor shall install new filters in the air handlers and clean all strainers in the water system just prior to the beginning of the testing and balancing.

E. The control manufacturer or its representative shall assist the test and balance agency in setting automatic dampers, valves, etc., as required.

F. The balancing agency shall prepare a certified report of all tests performed. The report shall be written on standard forms prepared by NEBB or AABC or facsimiles thereof. The balancing agency shall submit 3 copies of this report to the Subcontractor who shall submit them to the A/E for review and distribution.

G. The air shall be balanced to within + 10% of design requirements. Two apartments of each type shall have total air flow checked and adjusted (not individual outlets). The remainder of the units shall be set to the same fan speed as is adjusted in the sample units.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 DUCTWORK INSULATION

A. Provide necessary materials and accessories for installation of interior and exterior ductwork insulation as specified and/or detailed on drawings. Insulation type and thickness for specific ductwork systems shall be as listed in insulation schedule in this section of specification.

B. Provide insulation materials manufactured by Armstrong, Certain-Teed/Saint Gobain, Johns-Manville or Owens-Corning.

C. Insulation and application adhesives, except where specified otherwise, shall have fire and smoke hazard rating as tested by ASTM E-84 procedure not exceeding:

FLAME SPREAD	25
FUEL CONTRIBUTED	50

Insulation shall meet ASTM C411 performance test and shall be installed in conformance with NFPA Standard 90A.

D. Abbreviations for manufacturers of adhesives, insulating cements and coatings specified shall be C.M. for Chicago Mastic Company, B.F. for Benjamin Foster Company and 3M for 3M Company. Average thermal conductivity is expressed in BTU/Hr/Sq.Ft./ degrees F/In.

E. Install interior duct liner insulation cut to insure tight fitting corner, and longitudinal joints. Apply liner to sheet metal with 100% coverage of C.M. No. 176-477, B.F. No. 81-19 or 3M No. 36 adhesive applied in accordance with manufacturers recommended applications rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18" or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:

1. Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3" of leading edge of each section 12" O.C. around joint perimeter and 3" from longitudinal joints 12" O.C. Elsewhere space fasteners 18" O.C. except not more than 6" from longitudinal joints9 not 12" from corner break.

F. Provide round sheet metal ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply insulation with joints tightly butted together with longitudinal and end joint strips sealed with vapor barrier adhesive. Insulate fittings with insulation thickness equal to adjoining insulation with cover overlapping 2" onto adjacent covering.

G. Duct insulation materials by type shall be as follows:

1. Type 1-DIL: Internal acoustical and thermal duct insulation for low and high velocity ductwork shall be CertainTeed Ultralite 300 3 lb. density duct lines with .24 K factor at 75 degrees F mean temperature.
2. Type 2-DEW: External thermal insulation for low, medium and high pressure round duct shall be Shuller Microlite Type 75 standard duct insulation type IV with foil-scrim-kraft facing and .27 BTUH thermal conductivity at 75 degrees mean temperature.

2.2 HVAC DUCT PIPING SCHEDULE

DUCTWORK SYSTEM	TYPE	DUCT LINING THICKNESS
Common Areas, Attics or Unconditioned Area:		
Rectangular Supply	2-DEW	1-1/2"
Rectangular Return	NONE	
Round Supply	2-DEW	1-1/2"
Exhaust	NONE	

Ducts located in unconditioned areas shall be insulated to R-8 minimum.

2.3 PIPING INSULATION

A. General Requirements

1. Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.
2. Provide insulation materials manufactured by Armstrong Cork Co. Certain/Teed Saint Gobain, Dow Chemical, Johns-Manville or Owen-Corning Fiberglass.
3. Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as rested by ASTM E-84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

4. Provide insulation accessories such as adhesives, mastics, cements, tape and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke safety shall be permanent.
5. Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips or fitting covers.
6. Undamaged insulation systems on cold surface piping and equipment shall perform

their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

7. Insulation of removable heads, manholes access covers, etc., shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.
8. Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

B. Insulation Materials and Application Methods (Piping)

1. TYPE 1-PHC: Insulation for hot and cold surface piping systems with +40 degrees F to +450 degrees F operating range shall be Owens-Corning Fiberglass 25, 4.0 lb. density pipe insulation with white fire retardant ASJ jacket. Average thermal conductivity shall not exceed .26 BTU/Hr. at 75 degrees F mean temperature. Seal longitudinal jacket laps and butt strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:
   a. Insulate exposed and concealed valves and fittings with 2" thick glass fiberglass inserts or blankets. Cover fittings with Zeston Products PVC fitting covers or approved equal. PVC fitting covers shall be secured with mechanical fasteners such as tacks or staples for temperatures above 75 degrees F. For cold service all joints shall be sealed with vapor barrier adhesive or by pressure sensitive vapor barrier vinyl tape.

2. Type 1-PC: Insulation for cold surface equipment insulation for external surfaces with +40 degrees F to +220 degrees F operating temperature range shall be Armstrong FR/Armaflex pipe or sheet insulation as required with 5.5" or 6.0 lb. density. Average thermal conductivity shall not exceed .27 BTU/HR at 75 F mean temperature. Apply insulation directly to metal surfaces and seal insulation joints with Armstrong No. 520. Insulation shall be mitered, beveled and built-up as required to provide a smooth and neat exterior surface. On large pumps and equipment provide joints in insulation at points where equipment casing must be disassembled for maintenance and repair. Insulate these joint areas so that insulation can be easily removed from casing joints without removing or damaging adjacent insulation. Finish insulation with two coats of Armstrong Armaflex vinyl-lacquer finish.

D. Insulation Materials and application methods (hangers, supports, anchors, guides, expansion joints, etc.)

1. Insulation materials and application methods for piping hangers supports, anchors, guides expansion joints, etc., shall be as follows:

Insulate hangers and supports from direct contact with 3" and above piping with Styrofoam HD-300 plastic foam inserts of half or full sections. Provide inserts with vapor barrier jacket for lapping 2" over adjoining insulation. Insert jacket shall be equal in performance and appearance to adjacent pipe insulation jacket. On 1-1/4" to 2-1/2" piping, protect insulation with properly sized wood dowels cut within insulation. 1" pipe and below needs no inserts. Seal joints with vapor barrier sealer specified for insulation type used.

2. Where piping hanger cannot be isolated from cold pipe surfaces insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to point 12" above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer for insulation type used.
3. Pipe and Valve Insulation Schedule

SYSTEM	SIZE	TYPE	THICKNESS
Refrigerant Suction	Below 7/8”	1-PC	5/8”
Refrigerant Suction	Above 7/8”	1-PC	1”

PART 3 - EXECUTION

END OF SECTION 230700

SECTION 233100 - DUCTWORK

PART 1 - GENERAL

1.1 GENERAL

A. Construct ductwork as detailed on drawings and as detailed in the latest edition of the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) Duct Manual. Details shown on project plans shall indicate specific construction methods to be used on this project, and shall be used in lieu of any alternate methods shown in SMACNA Duct Manual.

B. Provide two copies of 1/4" - 1'-0" scale fabrication drawings of proposed ductwork and equipment layout to Engineer for approval prior to fabrication. Drawings shall establish that ductwork and equipment will fit allotted spaces with necessary clearance for installation and maintenance. Indicate on drawings proposed details for attaching, anchoring and hanging ductwork and equipment from structural framing of building. Where departures from project plans are deemed necessary by Contractor, details and changes shall be clearly shown on fabrication drawings and reasons for proposed changes noted.

C. Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building structural framing.

D. Construct ductwork in accordance with operating static pressure range. Ductwork pressure classifications shall be as follows:

1. Systems operating static pressure 1/2" positive or negative of W.G. - Returns, all exhaust and relief ducts and supply ducts for fan coil units.

E. All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1" or 2" in height and width of ductwork as required to accommodate insulation thickness. Mount specialties such as turning vanes, campers, etc., to ductwork with that section insulated "Build Outs" to maintain continuity of thermal barrier.

F. Construct low pressure system ductwork to conform to latest edition of low pressure duct construction standards of SMACNA Duct Manual.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. Provide snap-lock duct on all round ductwork 12" and under. Any exposed ductwork shall be spiral wound type without sealant.

B. Sealing of low and high pressure ductwork shall be Class “C” caulked or gasket type joining system such as Ductmate. (Clubhouse / Common Areas)
C. Flexible ductwork shall be poly inner membrane with integral spiral wire. Provide 1” fiberglass insulation and outer vapor barrier membrane.

2.2 SHEET METAL SPECIALTIES

A. Specialties shall be factory fabricated items designed for low, medium or high velocity systems as required. Submit shop drawings on all specialties required with shop drawings of ductwork layout. Equivalents on prior approval. Specialties shall be as follows:

1. Turning Vanes: Single blade vanes mounted 2-1/8" on center on 24 gauge runners. Air turns by Barber- Coleman will be acceptable on low pressure only. Note: Turning vanes to be provided on all supply, return and exhaust ducts.
2. Extractors (Low Velocity): Carnes #1250 all aluminum air volume extractor. Unit shall be adjustable from full open to full closed position.
3. Dampers: Provide 24 gauge minimum galvanized metal blades supported on duct with metal supports and locked in position with locking type damper arm.
4. Fire Damper (Round): Prefco type CR frame 100% free area folding blade type with UL approved 165 degree fusible link. Fire Damper (Rectangular): Prefco model 5500 1-1/2 or 3 hr. as shown on plans or equal type BC frame, 100% free area, folding blade type with UL approved 165 degree fusible link. (Fire Damper Rectangular-Low Velocity). Prefco LPB frame with 165 degree fusible link. Provide radiation dampers where penetrating membrane only of fire rated barriers at all ceilings. Prefco 5680 at ceiling diffusers and at AHU’s for ceiling radiatin damper applications. Through penetrations shall be Prefco 5500 E6 LPB fire damper. Install fire dampers in accordance with NFPA-90A and UL Standards 555. Equivalent dampers by Ruskin.
5. Backdraft Dampers: Unless backdraft dampers are specified with a particular piece of equipment. Provide Cesco #BDA or equal with 16 gauge aluminum blade with oiled bearings mounted in steel frame. Blades shall be balanced and connected with tie bar. Provide end seals and blade seals. Equivalent by Ruskin.
6. Flexible Connections: Metaledge Ventglas prefabricated flexible connection of 3-1/4" wide heat and fire resistant neoprene coated glass fabric with two 3" wide 24 gauge metal strips attached to each edge. Vent Fabrics, Inc., Duro-dyne Corp. or equal.
7. Access Doors: Provide access doors in ductwork ceiling, walls, or floors for access to ductwork valves, controls, piping etc., installed under this contract. Doors and frame shall be formed of not lighter than USS #14 gauge and #16 gauge steel, respectively. Hinges shall be concealed loose pin spring type. Locks shall be flush, screwdriver, cam action type. Doors and frames shall be furnished in prime coat of Higgins, Milcor, Donley or equal.
8. Round take-off fittings from supply diffusers or registers to low pressure supply ductwork shall be Flexmaster #FLDE complete with locking

damper and air scoop. Equivalent by Atco, Air Control Products.

9. Low Pressure Flexible Duct: Thermaflex G-KM rated for 2" W.G. maximum positive and 2" W.G. maximum negative pressure and 2500 FPM maximum velocity. UL listed "UL-181 Standards Class I Duct Material" complying with NFPA Standards 90A and 90B. Duct shall be composed of inner polymeric liner duct bonded to coated steel wire helix. Equivalent by Wiremold, Cleavaflex, Flexmaster with fiberglass insulation and vinyl cover. Limit length to 6 ft.
10. Louvers: Provide Greenheck ESJ-202 extruded aluminum stationary blade louver with extended sill, birdscreen, mill finish. Equivalent by Ruskin, Nailor, Cesco, Louvers and Dampers, Carnes.
11. Fire/Smoke damper: Fire/Smoke Dampers: Prefco 5020 Combination damper with 165□ fusible link and 5800 MBZX power open spring closed unit, electric actuator. Equal to Ruskin, Cesco, Louvers and Dampers.

PART 3 - EXECUTION

3.1 Provide shoe type branch take-offs for rectangular duct and splitter dampers where teeing for Clubhouse and common areas.

3.2 Review Architectural Code plans to ascertain fire rated walls, floors, ceilings and membranes. Protect all mechanical penetrations appropriately and according to a U.L. detail.

END OF SECTION 233100

BLANK

SECTION 233400 - FANS

PART 1 - GENERAL (Reference Section 230500)

1.1 GENERAL REQUIREMENTS

A. Provide where shown on plans fans as hereinafter specified. Equivalent by Carnes, Cook, Penn, Greenheck, Acme, or Jenn-Air.

PART 2 - PRODUCTS

2.1 CEILING FANS

A. Ceiling mounted exhaust fans shall be of the centrifugal direct drive type. Housings shall be steel with duct collar and backdraft damper. Grilles shall be high-impact, non-yellowing polystyrene.

B. Access for wiring shall be internal with plug-in type disconnect. Provide radiation dampers where in rated ceilings.

C. Motor shall be on vibration isolators. Fan wheel shall be forward curved centrifugal type, dynamically balanced and bear the AMCA seal and U.L. label.

PART 3 - EXECUTION

3.1 N/A

END OF SECTION 233400

BLANK

SECTION 233700 - AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Provide where shown on plans grilles, registers and diffusers. Refer to schedule at the end of this section.

PART 2 - PRODUCTS

2.1 GRILLES, REGISTERS AND DIFFUSERS

A. Provide grilles, registers and diffusers as shown on the drawings and hereinafter specified. Set all units with rubber gaskets for air tight connection with mounting surface, see drawings for types, sizes, air flow and quantity.

B. Install all registers with curve of louver away from line of sight. Unless noted otherwise, provide duct mounted diffusers and registers with standard margins. Finish shall match room finish.

C. Provide proper mounting supplies and arrangements for areas shown. Check Architectural drawings for ceiling and all construction. Provide ceiling radiation dampers where in fire-rated ceiling.

D. Equivalent grilles, registers and diffusers by J&J, Price, Titus, Barber-Coleman.

E. Schedule – see drawings.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 233700

BLANK

SECTION 237000 - SPLIT SYSTEMS

PART 1 - GENERAL (N/A)

PART 2 - PRODUCTS

2.1 AIR HANDLERS

A. Air handling units shall be completely factory assembled including coil, condensate drain pan, fan motor(s), filters and controls in an insulated casing that can be applied in either vertical or horizontal configuration. Units shall be rated and tested in accordance with ARI standard 210/240, 340/360. Units shall be UL listed and labeled in accordance with UL 465/1995 for indoor blower coil units.

B. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Casing shall be completely insulated with cleanable, foil-faced, fire-retardant, permanent, odorless glass fiber material. All insulation edges shall be either captured or sealed. Knockouts shall be provided for unit electrical power and refrigerant piping connections. Captive screws shall be standard on all access panels.

C. Evaporator coil to have configured aluminum fin surface, mechanically bonded to 3/8” internally enhanced copper tubing and factory pressure and leak tested at 365 psig. Coil is arranged for draw-through airflow and shall provide a double sloped condensate drain pan constructed of PVC plastic.

D. Evaporator fan shall be double inlet, double width, forward curved, direct drive centrifugal-type fan(s). Thermal overload protection shall be standard on motor. Fan and motor bearings shall be permanently lubricated. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

E. Magnetic evaporator fan contactor, low voltage terminal strip, check valve(s), and single point power entry and disconnect shall be included. All controls shall be factory-installed and wired. Evaporator defrost control shall be included to prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

F. Filters shall be one inch throwaway. Filters shall be accessible from the front of the unit.

G. Provide manual changeover 7-day (not 5/2) programmable heating/cooling thermostat.

2.2 CONDENSING UNIT/HEAT PUMP

A. Casing shall be galvanized steel with weather resistant powder paint.

B. Refrigerant controls to include condenser fan and compressor contactor and control system. Compressor overload protection, and service valves are to be provided.

C. Hermetic compressor to have over temperature/pressure protection, epoxy-dipped windings. A 5 year limited compressor warranty to be included.

D. Condenser coil to be copper tubes, aluminum fins with brazed joints protected by louvered panels.

E. Provide all accessories for proper system operation taking into consideration refrigerant pipe length, exposure and position from AHU to account for each specific unit installation. Review drawings with supplier.

PART 3 – EXECUTION

3.1 Air handlers to be mounted on wall bracket with resilient neoprene pads, piped to appropriate drain, mounted with access for service, with flexible duct connections.

3.2 Outdoor units shall be mounted per detail on the drawings for roof-mounted units on synthetic pads. Ground mounted units shall be mounted on monolithic concrete pads that extend to building. Strap down conduits and secure DX piping to wall or slab where over 3 feet in length.

3.3 Install with clearances per manufacturer's recommendations.

END OF SECTION 237000

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. All contract documents including drawings, alternates, addenda, and modifications in addition to this specification are applicable to the Electrical Contractor (E/C) and his Subcontractors, and material suppliers.

B. Engineer, wherever used in the specifications, shall mean Latimer Sommers & Associates, P.A., 3639 S.W. Summerfield Dr., Topeka, KS 66614, 785-233-3232, lsapa@lsapa.com.

C. Contractor, wherever used in these specifications, shall mean the company that enters into contract with the General Contractor or Owner to perform this section of work.

D. When a word such as “proper”, “satisfactory”’ “equivalent”, and “as directed”, is used, it requires Engineer’s review. “Provide” means furnish, install, and commission.

E. Changes or deviations from the contract, including those for additional work, must be submitted in writing for review by the Engineer.

F. If conflicts or ambiguities are present between the drawings and specifications, the contractor shall contact the Engineer for clarification. If no resolution is made by the Engineer via an addendum, the more costly option shall be included in the contract. Contractor shall notify Engineer as soon as possible for a resolution.

G. Do not scale electrical drawings for dimensions. Accurately lay-out work from dimensions indicated on Architectural drawings unless such is found in error.

H. Items not shown on the drawings or in the specifications, but reasonably inferred from the documents shall be included in the contract.

I. Contractor may be allowed access to the CAD drawings files produced by the Engineer upon written release and payment of charges.

1.2 LOCATIONS AND INTERFERENCES

A. Contractor shall visit site to determine existing site conditions that affect the contracted work.

B. Locations of equipment, piping and other mechanical work are indicated diagrammatically by the drawings. Determine exact locations on site, subject to structural conditions, work of other Contractors, access requirements for installation and maintenance to the approval of the Engineer.

C. Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for installation. Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Engineer. Failure of contractor to coordinate with other trades prior to construction is not cause for additional compensation.

D. Any pipe, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

1.3 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 100 miles of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, critical instrumentation, computer workstation and programming.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
5. Asbestos products or equipment or materials containing asbestos shall not be used.
6. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

B. Warranty

1. Contractor warrants to Owner and Architect the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.
2. Contractor warrants to Owner and Architect that on receipt of written notice from either of them within one year warranty period following date of acceptance that defects have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
3. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, install equipment or accessories per these instructions including all items needed to fulfill these requirements. Any discrepancy between these instructions, Code, and the contract documents shall be brought to the attention of the Engineer for interpretation. Installation shall meet manufacturer’s recommended clearances. Any conflicts shall be brought to the attention of the Engineer prior to installation.

D. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

1.4 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS

A. The intent of these specifications is to allow competition in bidding on standards of materials and equipment required.

B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage unless shown otherwise on the drawings.

C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product may be used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

E. Prior to receipt of bids, if contractor wishes to incorporate products other than those named in specifications in his base bid, he shall submit a written request for review of substitutions to Engineer not less than five working days prior to bid time. Engineer may

review requests and acceptable items will be listed in an addendum issued to principal bidders.

F. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison. Differences between specified and submitted items shall be listed by the supplier/contractor and included with the submittal.

G. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical electrical service requirements necessary to accommodate such substitution; whether such affected elements to this contract or under separate contracts.

1.5 SUBMITTALS

A. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Information shall be clearly marked as to individual model to be provided on this project. Do not submit operations manuals, installation guides, wiring diagrams, or other voluminous documents unless requested by Engineer. If the Contractor feels these items are pertinent in the review, prior approval shall be obtained from the Engineer. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been reviewed, no change in brand or make will be permitted unless approved by the Engineer. If electronic submittals are used during the project, two hard copies with the appropriate approval seals shall be sent to the Engineer for his use and review.

B. Engineer may review submittals only as a courtesy to the contractor. Contractor has the obligation to provide items/work in the contract documents or reasonably inferred. The lack of comments, notes, or other indications made by the Engineer on a submittal does not relieve the contractor from providing the necessary items/work. Review by the Engineer does not constitute “approval” of items submitted. Engineer will not check quantities, dimensions, etc. for accuracy or appropriateness.

C. Forward submittals in sufficient time to permit proper consideration by the Engineer. Provide submission to assure adequate lead time for procurement. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion. Engineer shall endeavor to review submittals in two weeks.

D. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor and shall contain the list of items, name of project, name of Contractor, supplier and their contact numbers, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of

location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, submittals shall be marked to indicate specific items submitted for approval. Submittal shall bear the Contractor's approval stamp indicating they have reviewed the submittal for conformance to the contract documents.

E. Where required by these specifications, the drawings, or the Engineer, provide scaled shop drawings of the piping systems and/or equipment to reflect actual routing, location, coordination with other trades and structure, and maintenance accessibility. Review with Engineer scope of the documents prior to submission.

F. Upon request of the Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

1.6 OPERATIONS AND MAINTENANCE MANUALS

A. Submit two copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Instructions shall be prepared by equipment manufacturer.

B. Present to Owner, keys and wrenches furnished with equipment under this contract and obtain receipt for same upon completion of project.

C. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Provide brochures bound in three-ring binders with metal hinge. Clearly print project and section covered on label insert of each brochure. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked.
2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
3. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
4. A complete set of as-built drawings to scale showing all electrical systems as installed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for

the protection of such equipment and material against any damage. This shall include any existing, relocated or owner-furnished equipment/systems.

2. Place damaged equipment in first class, new operating condition; or replace same as determined and directed by the Engineer. Such repair or replacement shall be at no additional cost to the Owner.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before installing or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or cleaned as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.8 SAFETY AND SECURITY

A. Visits to the site shall be pre-arranged through the Owner’s representative.

B. Contractor shall follow OSHA safety regulations while on site and have an OSHA-trained individual on site at all times.

C. Contractor shall follow Owner’s safety and security regulations with regards to identification, keys and access, document control, motor vehicles, firearms, illegal substances, smoking, etc as per the Owner’s request.

D. Contractor shall follow fire safety rules per OSHA and NFPA standards regarding temporary facilities, maintaining fire exiting, fire suppression and alarm systems, hot work, storage, utilities, etc.

1.9 DISPOSAL AND RETENTION

A. Waste materials, including those considered hazardous, accrued from the construction process shall be removed promptly from the project site in a manner approved by the authorities having jurisdiction.

B. Verify with the owner any items that may be retained by the owner for future use or salvage prior to removal.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

B. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

C. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.3 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.4 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods shall conform to the requirements of other sections of this specification. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the owner.
2. Assemblies of motors, starters, controls, and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers or heaters.
   b. Other wiring at boilers or heaters and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1, Part 31.4.4.2.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements generally defined by motor manufacturers as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act of 1992 (EPACT). Motors not specified as “high efficiency” shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.5 ELECTRICAL REQUIREMENTS

A. Electrical work required to install and control electrical equipment which is not shown on plans or specified under sections in series 26000 shall be included in E/C's base bid proposal.

B. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design shall be paid for by E/C at no cost to Owner or A/E.

2.6 FIRESTOPPING

A. Provide an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping with a U.L. listed firestop material and in a U.L. listed assembly configuration. Submit material and assembly detail for review.

2.7 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of piping, sleeves, inserts, hangers, and equipment, access provisions, and work of all trades. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

C. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed.
2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by A/E.
3. Do not penetrate membrane waterproofing.

D. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown, but must be provided.

E. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

F. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Engineer. Damaged or defective items in the opinion of the Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

G. Concrete and Grout: Use concrete and shrink compensating grout 3000 psi minimum

H. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

I. Inaccessible Equipment:

1. Where the A/E determines that the E/C has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY POWER AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

D. All temporary shut-downs of service shall be coordinated with the owner and other trades as needed to maintain operating service in the facility. Off-hours work is normally needed to accomplish these and shall be included in the contract.

3.3 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by E/C and will be considered by A/E under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for operation and maintenance of service.

D. E/C shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

3.4 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, equipment and systems shall be thoroughly cleaned and painted.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
3. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.5 STARTUP AND TEMPORARY OPERATION

A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION 260500

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SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL (Reference Section 260500)

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform with color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller may be solid or stranded.

B. Use no conductors smaller than No. 12 gauge unless specifically called for or approved by Engineer. Size wire for 120 volt branch circuits for 3% maximum voltage drop. Size feeder circuits for 2% maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5% maximum. In no case shall feeders and wires be smaller than that shown on plans.

C. Lighting and Receptacle Circuits: Type THHN/THWN, 600 volt, 75 degrees C (167oF) copper thermoplastic insulated building conductor. Romex wiring (Type NM), copper, may be used for all branch circuiting where allowed by Code and local jurisdiction.

D. Feeders: Type AA8000 compact aluminum alloy may be used for feeders of #1 and above or as noted on the drawings. Sizes shall meet ampacity requirements of the overcurrent protection and voltage drop.

E. Provide conductors by Anaconda, General Cable, General Electric, Phelps Dodge, or equivalent.

2.2 CONDUCTOR INSTALLATION

A. Run conductors in conduit continuous between outlets and junction boxes with no splices or taps.

B. Neatly route, tie and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Panduit.

C. Make circuit conductor splices with Buchanan crimped-on solderless connectors and snap-on nylon insulators or equivalent.

D. Make fixture and device taps with Scotchlok self-stripping electrical tap connectors.

E. Terminate solid conductors at equipment terminal strips and other similar terminal points with insulted solderless terminal connectors. Terminate all stranded conductor

terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sta-Kon insulated terminals and connectors or equivalent by API/AMP, Blackburn, Buchanan or Scotchlok.

F. Where a total of six or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks provide Buchanan 600 volt heavy duty Type HO sectional terminal blocks with mounting channel and No. 23 see-thru covers. Equivalent terminal blocks by General Electric, Square D or Westinghouse.

G. Wrap conductor taps and connections requiring additional insulation with a minimum of three overlapped layers of 3M scotch vinyl plastic electrical type No. 88 or equivalent.

2.3 CONDUCTOR COLOR CODING

A. Provide continuous color coding for feeder, branch and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not available in larger wire sizes color code conductor at all accessible locations with Scotch 35 all-weather color code tape.

B. Identify the same phase conductor with same color throughout.

C. Provide conductors with color coding indicated. Where more than one standard voltage system is installed provide same colored conductors with indicated tape or stripe to indicate system voltage.

2.4 OPENINGS, ACCESS PANELS AND SLEEVES

A. This contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. E/C shall set and verify the location of sleeves as shown on structural plans that pass through beams, only if so shown. All floor penetrations be sealed to meet fire rating requirements.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 - GROUNDING

1.1 GENERAL REQUIREMENTS

A. Supplement grounded neutral of secondary distribution system with equipment grounding system, installed so that metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items operate continuously at ground potential and provide low impedance path for ground fault currents.

B. System shall comply with National Electrical Code, modified as indicated on drawings and as specified.

PART 2 - PRODUCT (Not Applicable)

PART 3 - EXECUTION

3.1 GROUNDING CONNECTIONS

A. Provide equipment ground bus in base of low voltage, main distribution equipment brazed or otherwise adequately connected by an approved method to at least three 3/4" diameter by 10'-0" long ground rods. Where required, to meet requirement of specified tests, extra rods shall be installed at no additional cost to Owner. Rods shall be located a minimum of 6 feet from each other or any other electrode and shall be interconnected by a minimum 4/0 bare copper conductor brazed to each ground rod below grade.

B. Provide #4 bare copper conductor properly connected to not less than 20 linear feet of additional #4 bare copper conductor located within and near the bottom of a concrete foundation that is in direct contact with earth. Provide a minimum of 2" concrete cover over the grounding electrode.

C. Connect system neutral ground and equipment ground system to common ground bus.

D. Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with National Electric Code. Provide each service disconnect enclosure with neutral disconnecting means which interconnects with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

E. Required equipment grounding conductors and straps shall be sized in compliance with N.E.C. Table 250-95. Equipment grounding conductors shall be provided with green type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus. Aluminum conductors, straps or bars may be

substituted for copper items if consistent with materials used for phase conductors. Substitute materials shall be comparable in current carrying capacity, temperature rise, and mechanical strength. Installation shall include necessary precautions regarding terminations with dissimilar metals.

F. Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or three-phase feeder. Single phase 120 and 277 volt branch circuits for lighting and power shall consist of phase neutral and grounding conductors installed in common metallic conduit. Provide flexible metallic conduit utilized in conjunction with above single phase branch circuits with continuous suitable green insulated grounding conductors. Install grounding conductor in common conduit with related phase and/or neutral conductors. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

G. Contractor shall determine number and size of pressure connectors to be provided on equipment grounding bars for termination of equipment grounding conductors in panelboards and other electrical equipment. In addition to active circuits, provide pressure connectors for panel spares and blank spaces.

H. Provide electrical expansion fitting with an external flexible copper ground securely bonded by approved grounding straps on each end of fitting except where UL approved built-in copper grounding device is provided.

I. Provide steel and aluminum conduits which terminate switchboards, panelboards, motor control centers, motor starters and disconnect switches to metallic housing of electrical equipment with ground bushing and connect each bushing with bare copper conductor to ground bus in electrical equipment.

3.2 GROUNDING TEST

A. Test complete equipment grounding system at each service disconnect enclosure ground bar with Vibroground test unit manufactured by Associated Research Inc. Resistance, without chemical treatment or other artificial means shall not exceed fifteen (15) ohms to ground.

B. Electrical Contractor shall oversee grounding tests at successful completion of installation of grounding system and shall submit certified test reports of ground tests to Architect-Engineer.

END OF SECTION 260526

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

PART 2- PRODUCTS

2.1 STEEL CONDUIT

A. Galvanized rigid steel conduit: Conduit shall be hot dipped galvanized and shall bear an U.L. label. Conduit shall also meet Federal Specification W-WC-581 and ANSI C80.1.

B. IMC Conduit: Conduit shall be galvanized intermediate metal conduit manufactured in accordance with UL 1242 and meeting the requirements of Federal Specification WWC-501.

C. EMT Conduit: Conduit shall be galvanized steel electrical metallic tubing and bear an Underwriters' Laboratory label. Conduit shall conform to Federal Specification WWC-563 and ANSI specification C80.3.

D. Contractor may use either rigid steel, IMC or EMT for all circuiting. Clubhouse wiring shall be EMT for all home runs and to first box or device where a transition to MC cable may occur.

E. Flexible Conduit: Flexible conduit shall have a water resistant non-sleeving polyvinyl chloride jacket with a general temperature range of -40 degrees C to +60 degrees C. Conduit shall bear an UL label.

F. Flexible conduit lengths of 4' or more require review by Engineer. Contractor shall use flexible conduit for connections to motors and equipment mounted on resilient mounts or vibration isolators. MC cable may be used in gypsum board walls between outlets.

G. PVC Conduit - Schedule 40 PVC by Carlon can be used below slab or grade. Flexible PVC conduit (Smurf pipe) may be used if local code allows for telecom and CATV cabling.

2.2 FITTINGS

A. Rigid Steel and IMC Conduit: Couplings shall be steel threaded type and box connectors shall be malleable iron insulated grounding bushings and malleable iron or steel locknuts. Unilets shall be malleable iron with blank cover.

B. EMT Conduit: Couplings shall be steel or malleable iron set screw type. Box connectors shall be malleable iron and malleable iron or steel locknuts. Unilets shall be malleable iron with blank cover.

C. Flexible Conduit: Connector shall be steel or malleable threaded type iron with grounding ferrule and insulated throat.

D. Where conduits cross building expansion joints provide O-Z expansion fittings type "AX", "TE", "EX", or "EXE" as required.

2.3 PLASTIC CONDUIT

A. Provide rigid polyvinyl chloride (PVC) type EPC 40 heavy wall plastic conduit meeting current NEMA Standard TC-2. Conduit shall be listed UL 651 for underground and exposed use.

B. Plastic conduit may only be used for exterior underground applications or circuits beneath slabs on grade except as noted. Provide EMT radius bends and risers for conduits above 1" that rise above grade/slab.

C. Provide exterior underground conduit with metal detection strip.

D. Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.

E. Joining and bending of conduit and installation of fittings shall be done only by methods recommended.

F. Provide conduit support spacing as recommended for the highest ambient temperature expected.

G. Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.

H. Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.

I. Plastic conduit and fittings shall be by a Products Division of Continental Oil Company.

2.4 OUTLET BOXES

A. Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures and switches with Steel City, Raco, or equivalent. Thermoset fiberglass knockout boxes of required depth for service or device may be used within apartment units. Steel boxes to be used in exposed areas such as the garage. PVC or steel may be used in other Common areas.

2.5 LOCATION OF OUTLET BOXES

A. Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations. Install all boxes according to ADA requirements.

B. Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from bench

marks, columns, walls, or floors. Rough-in lighting fixtures and appliance outlet boxes to general locations before installation of walls and furring and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building.

C. Install outlet boxes accessible and according to ADA. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork. Boxes for ceiling fans shall be rated as such.

D. Install bottom of switch outlet boxes 48" above floor unless otherwise called for or required by Wainscot, Counter, etc. Install bottom of receptacle outlet boxes 16" above floor unless otherwise called for on drawings.

E. Install outlet boxes at elevations indicated on drawings or as directed by Architect. Center bracket lights over mirrors with 2" clearance above mirror. Thermostats shall be 48".

F. See architectural drawings for specific accessible mounting heights.

2.6 PULL BOXES, WIREWAYS AND GUTTERS

A. Provide Alwalt, Keystone, Universal or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform with NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc. as required.

B. Special items may be fabricated locally, to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.

C. Provide sectional covers for easy removal.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. In general conceal conduit within walls, floors, roof construction or furred spaces. Expose only feeder and short connections to equipment in equipment rooms unless noted otherwise. Install exposed conduit parallel or at right angle to building lines.

B. Install conduit to requirements of structure, other work on project and clear of openings, depressions, pipes, ducts, reinforcing steel, etc. Install conduit in concrete forms so that strength of structure will not be affected.

C. Align conduit terminations at panelboards, switchboards motor control equipment, junction boxes, etc. and install true and plumb. Provide supports or templates to hold conduit alignment during rough-in stage of work.

D. Install conduit continuous between outlet boxes, cabinets and equipment. Make bends smooth and even without flattening or flaking conduit. Radius of bends shall not be shorter than radius listed table 346-10 (b) of NEC. Long radius elbows may be used where necessary.

E. Ream and clean conduit before installation and plug or cover openings and boxes to keep conduit clean during construction.

F. Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Fasten conduit securely in place with approved straps, hangers, and steel supports. Provide O-Z cable support to support conductors in vertical raceways as required by NEC Table 300-19 (a) of NEC.

3.2 INSERTS, HANGERS

A. Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box. Where plastic conduit is used follow manufacturer's recommended hanger spacing.

B. Install multiple runs of conduits as follows:

1. Where a number of conduits are to be run exposed and parallel, group and support with trapeze hangers.
2. Fasten hanger rods to structural steel members with suitable beam clamps and to concrete structures with inserts set flush with surface. Install concrete inserts with reinforced rod through opening provided in inserts.
3. Inserts shall be Grinnell figure 279, 281, 282, or 285 or equivalent as required by load and concrete thickness.
4. Provide beam clamps suitable for structural members and conditions.
5. Provide 3/8" minimum diameter steel hangers rods galvanized or cadmium plated finish.
6. Trapeze hangers shall be Kindorf Series 900 channel with fittings and accessories as required.
7. Attach each conduit to trapeze hanger with Steel City No. C-105 clamps for rigid conduit and Steel City No. C-106 clamps for electrical metallic tubing. (EMT).

C. Install clamps for single conduit runs as follows:

1. Support individual runs by approved pipe straps, secured by toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. Use of perforated strap not permitted.

2. Install exposed conduits in damp locations with clamp backs under each conduit clamp to prevent accumulation of moisture around conduits.

D. Provide inserts, hangers and accessories with finish as follows:

1. Galvanized: Concrete inserts and pipe straps.
2. Galvanized or Cadmium Plated: Steel bolts, nuts, washers and screws.
3. Painted with Prime Coat: Individual hangers, trapeze hangers and rods.

E. Equivalent hangers and support systems by Binkley, Fee and Mason, Kin-Line or Unistrut.

3.3 BUSHINGS AND LOCKNUTS

A. Enter outlet boxes squarely and securely clamp conduit to outlet box with bushing on inside and locknut on outside. Provide Thomas and Betts 3800, Efcor 56 series or equivalent threaded malleable iron insulated throat grounding bushings.

B. Terminate metallic conduits at switchboards, panelboards, control cabinet, etc. with O-Z Electrical Manufacturing Company Type "BL" or "IGB" grounding type insulating bushings. Ground bushings to equipment grounding buss.

3.4 SLEEVES

A. Furnish proper type and size sleeves to General Contractor for electrical ducts, busses, conduits, etc. passing through building construction. Supervise installation to insure proper sleeve location. Unless indicated or approved install no sleeves in structural members.

B. All holes or voids created by the electrical contractor to extend pipe through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall be ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

END OF SECTION 260533

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SECTION 262400 – PANELBOARDS AND SWITCHBOARDS

PART 1 - GENERAL

1.1 Provide distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic case circuit breakers of frame and trip ratings as shown on the schedule.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKER PANELBOARDS

A. Provide dead-front panelboards with bolt-in molded case circuit breakers as listed in schedule. Panelboards shall conform to NEMA Standard Publication No. PB-1 and UL Standards No. 50 & 67 for panelboards.

B. Boxes shall be galvanized steel standard width and depth except where scheduled otherwise. Fronts shall be code gauge steel finished with rust-inhibiting primer and baked enamel finish. Fronts shall have flush doors with flush cylinder tumbler type locks, spring-loaded door pulls, concealed door hinges. Provide doors higher than 48" with three point catch. Panel door locks shall be keyed alike. Provide fronts designed for flush or surface mounting as indicated and attached to box by adjustable trim clamps.

C. Provide tin-finished aluminum bars full length of panel with rating listed in schedule. Bus bar connection to branch circuit breakers shall be "Phase Sequence" type designed and assembled so circuit breakers can be replaced without disturbing adjacent breakers or removing main bus or branch circuit connectors. Provide bus bars with wire lugs suitable for copper or aluminum conductors. Provide each panel with equipment grounding bus grounded to box and neutral bus insulated from box.

D. Branch circuit breakers shall be quick-make, quick-break with trip indication. Circuit breakers shall operate both manually for normal switch functions and automatically under overload and short circuit conditions. They shall provide circuit and self-protection when applied within their rating. Operating mechanisms shall be entirely trip free so that contacts cannot be held closed against a short circuit. Operating handle of circuit breaker shall open and close all poles of a multi-pole breaker simultaneously and conform to NEMA Standards Publications No. PB-1 and be approved by UL. Circuit breaker shall have a thermal magnetic trip unit for each pole for inverse time delayed overload protection and an instantaneous magnetic element for short circuit protection. Trip elements shall operate a common internally connected trip bar to open all poles in case of overload or short circuit through any one pole. Panel shall provide for branch circuit breakers, shall be up to 100 amperes, and unless indicated otherwise shall have 10,000 RMS (120/208V) short circuit amperes symmetrical interrupting capacity or as listed in the schedules. Breakers shall be one, two or three pole type as indicated in panel schedule.

E. Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed list of branch circuit loads corresponding to branch circuit numbers.

F. Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed list of branch circuit loads corresponding to branch circuit numbers.

G. Panelboards for apartments shall be Square "D" QO and Square “D” NQOD for all others 400 A and less (common areas).

H. See panelboard schedules

2.2 UL LISTING

A. Panelboards shall be listed by Underwriters Laboratories and shall be the UL label. When required, panelboards shall be suitable for use as service equipment.

2.4 EQUIVALENT BY CUTLER HAMMER, ITE, G.E.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 262400

SECTION 262726 - SWITCHES, RECEPTACLES AND COVER PLATES

PART 1 - GENERAL (Not applicable)

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

A. N.E.C. Compliance - Comply with the N.E.C. as applicable to construction installation of electrical wiring devices.

B. U.L. Compliance and Labeling - Provide electrical wiring devices which have been U.L. listed and labeled.

C. N.E.M.A. Compliance - Comply with the N.E.M.A. standards for general and specific purpose wiring devices.

D. Provide factory fabricated wiring devices, in types, colors and electrical ratings for applications indicated and complying with N.E.M.A. standards. Where types and grade are not indicated, provide proper selection as determined by the installer and approved by the owner to fulfill the wiring device requirements. Provide gray colored devices except as otherwise selected by the architect and verified by the owner.

2.2 ACCEPTABLE MANUFACTURES

A. Provide products produced by one of the following manufactures:

Hubbell Inc.	Steel City
Pass & Seymour	Midland Ross
Leviton	Raceway Components

2.3 RECEPTACLES

A. Duplex Receptacles – For all areas except within apartments provide specification grade, single outlet, 20 amp, 125 volt, N.E.M.A. configuration 5-20R receptacles with high impact ivory nylon faces, back and side wired, heavy duty triple wipe "T" contacts. Hubbell 5351, P&S 5361, Lev. 5361. Within apartments provide residential grade, 15 amp (20 amp for dedicated circuits), 125 volt, N.E.M.A. configuration 5-15/20R receptacles. With high impact ivory faces, back and side wired. Devices shall be tamper-proof where required by Code: Hubbell RR15SITR, RR201ITR

B. Isolated Ground Receptacles - Provide specification grade, 20 amp, 125 volt, N.E.M.A. configuration 5-20R duplex receptacles. Shall have the isolation method as an integral part of the device, high impact orange nylon face, back and side wired, heavy duty triple wipe "T" contacts. Hubbell IG5362 or approved equal.

C. Surge Suppression Duplex Receptacles - Provide specification grade, 20 amp, 125 volt, N.E.M.A. configuration 5-20-R Surge Suppression receptacles. With three mode protection, both visual and audible indicators, high impact blue nylon face. Hubbell 5352-S or approved equal.

D. Illuminated Receptacles - Provide specification grade, 20 amp, 125 volt, N.E.M.A. configuration 5-20R duplex receptacles. With illuminated high impact nylon faces and heavy duty triple wipe "T" contacts. Hubbell 5362IL or approved equal.

E. Ground Fault Receptacles - Provide specification grade, 20 amp, 125 volt, ground fault circuit interrupter duplex receptacles. With a 5 milliampere trip level, feed-thru type, capable of protecting connected downstream receptacles. Hubbell GFTR20I.

F. Weatherproof Convenience Outlets - Duplex receptacles needing to be weatherproof shall be supplied with an aluminum cover with two spring held covers, one over each outlet and each with a rubber watertight gasket. Hubbell 525WO, P&S WPD-8, standard box mounting. Hubbell 5206WO, P&S 4510, FS/FD box mounting. Provide flush in-use boxes with clear plastic covers by Arlington.

   GFCI receptacles use Hubbell CWP26H, P&S WPH-26, standard box mounting. Hubbell WPFS26, P&S 4511, FS/FD box mounting.

G. Combination USB and Receptacle – Provide Leviton #T5630-W 15 amp combination ivory receptacle and USB Charger. 15 Amp, 125 Volt, tamper-resistant, NEMA 5-15R. 2.1 Amp, 5VDC, 2.0/3.0 Type A USB Chargers. Grounding, Side Wired & Back Wired - Ivory.

2.4 SWITCHES

A. Single Pole - Provide specification grade, single pole, 20 amp, 120-277 volt, AC ivory quiet type switches. Equipped with mounting yoke insulated from the switching mechanism, color coded by amperage tops, back and side wired. Hubbell 121I, P&S 20AC1-I, Lev. 1221I.

B. Three-Way - Provide specification grade, three-way, 20 amp, 120-277 volt, AC quiet type ivory switches. Equipped with mounting yoke insulated from the switching mechanism, color code by amperage tops, back and side wired. Hubbell 1223I, P&S 20AC3-I, Lev. 1123I.

2.5 COVER PLATES

A. Provide cover plates for all wiring devices. Plates must be compatible with the wiring devices. Provide blank plates as required.

B. Cover plates for switches, convenience outlets, blank outlets, telephone, etc....shall be smooth ivory plastic.

C. Cover plates in unfinished areas shall be galvanized steel.

D. Labeled plates shall be permanently engraved with appropriate lettering.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which wiring devices are to be installed and notify the general contractor in writing of conditions detrimental to proper and timely completion of the work. Do no proceed with the work until unsatisfactory conditions have bee corrected in a manner acceptable to the installer.

3.2 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in compliance with manufacturers written instructions, applicable requirements of N.E.C. and N.E.M.A. standards in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work as necessary to interface installation of wiring devices.

C. Install wiring devices only in electrical boxes which are clean, free from excess building materials, dirt and debris.

D. Install wall mounted receptacles with the ground slot up. Install floor receptacles parallel to the adjacent wall.

E. Delay installation of wall plates until painting work is completed.

F. Upon installation of wall plates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 TESTING

A. Testing - Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 262726

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SECTION 262813 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

PART 2 - PRODUCT

2.1 FUSES

A. Provide fuses of same manufacturer and characteristics as scheduled to insure selective coordination of power system. All fuses shall be listed by Underwriters Laboratories, Inc. with an interrupting rating of 100,000 amperes R.M.S. symmetrical.

B. Install fuses only after installation is complete and final tests and inspections have been made. Label fuses, switches and other fused devices with warning labels affixed in prominent location indicating type and size of fuse installed and fuse manufacturer's catalog number.

C. Fuses 600 amp and below shall be U/L Class dual element, time delay sized as shown on drawings or schedules.

D. Special temperature conditions, motors, motor loads or other conditions requiring other types or sizes of fuses must be reviewed by the Engineer. Fuse reducers are not permitted.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 262813

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SECTION 262816 - METER CENTERS AND DISCONNECT SWITCHES

PART 1 - GENERAL

PART 2 - PRODUCT

2.1 METER CENTERS

A. Provide meter centers complete, as intended and as shown on plan for outdoor usage and in coordination with power company.

B. Provide Square D EZ Meter-Pak, rainproof as shown on risers with main where shown and individual main breakers to units.

C. Bus shall be 65,000 minimum AIC. Tenant breakers shall be 65,000 minimum AIC.

D. Equivalent by Cutler-Hammer, ITE, G.E.

2.2 DISCONNECT SWITCHES

A. Provide heavy duty horsepower rated Safety Switches rated in accordance with NEMA enclosed Switch Standard KS 1-1969 and L98 Standard.

B. Enclosure shall be NEMA type required by switch location and environment. Enclosure door shall latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity and application information.

C. Line terminals shall be permanently marked and shielded. Contact shall be tin plated, equipped with arch chutes and have moving contacts visible in off position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break spring driven anti-tease mechanism and be integral part of box. All current carrying parts shall be plated.

D. Fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required. Fuse holders shall be completely accessible from front of switch.

E. Provide switches by Square "D", Cutler Hammer, ITE, G.E.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 262816

BLANK

SECTION 265100 - LIGHTING

PART 1 - GENERAL (Reference 260500)

PART 2 - PRODUCTS

2.1 LAMPS

A. Fixture lamps shall be lamp type recommended by fixture manufacturer. Lamp no fixtures above manufacturers recommended maximum wattages.

B. Equivalent lamps by Venture, Phillips or Sylvania.

2.2 LAMP BALLASTS

A. Fluorescent fixture ballast shall be Advance Discrete electronic type with 10% THD max. Provide VLH-Es ballasts where light fixtures are located in a fire rated ceiling.

B. Ballast for exterior lighting or in areas where fixtures are required to operate below 50 degrees F (i.e., coolers and freezers) shall have ballasts designed for low ambient operation.

C. Equivalent by Motorola, Universal.

2.3 LED

A. Provide LED light sources in 3000-4000K per the schedule. Life shall be 50,000 L70 minimum.

B. Sources and drivers shall be compatible manufacturers warranted for five years minimum.

2.3 FIXTURES

A. General Requirements

1. Provide fixtures complete with lamps and accessories required for hanging. Contractor shall insure that lamps, reflector lens and trim are clean at time of final inspection. Mount recessed fixtures with trim flush to ceilings, fee of gaps or cracks.
2. Coordinate mounting of ceiling mounted luminaires with Contractor. Where additional fixture supports are required due to fixture location or weight, supports shall be provided by this Contractor, unless otherwise specified under ceiling specifications.

3. Consult architectural plans for ceiling types and provide surface and recessed

fixtures with appropriate mounting components and accessories.

4. Where equivalent, manufacturers are listed in fixture schedule, fixtures by these manufacturers will be acceptable provided fixture submitted meets or exceeds specified fixtures in performance and construction and appearance.
5. Provide luminaires at each outlet shown on drawings. Fixture shall be in accordance with type designation on drawings.
6. Fixtures supports shall comply with NEC Sections 410-15 and 410-16. Provide fixture securing clips as required.
7. Luminaires which are recessed in one hour rated ceiling shall be fire retardant. Gypsum board enclosures meeting IBC, NEC and UL requirements shall be provided in rated ceilings per the architectural Code drawings.
8. See Luminaire Schedule.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 265100

SECTION 271000 - TELECOMMUNICATIONS

PART 1 - GENERAL SPECIFICATIONS

1.1 SCOPE

A. This document describes the products and execution requirements relating to furnishing and installing Voice, Data and CATV. Horizontal cabling comprised of copper, support systems are covered under this document.

B. The Horizontal (workstation) Cabling System shall consist of a minimum of 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. Cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR). In the Telecommunications Room, they shall be routed to the appropriate rack and terminated as specified in this document.

C. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications Contractor as detailed in this document and the project drawings.

D. Product specifications, general design considerations, and installation guidelines are provided in this document. Typical installation details, cable routing and outlet location and types will be provided on the project drawings, an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.2 REGULATORY REFERENCES

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, NEC, the local Electrical Code, authority having jurisdiction and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. The performance of all modular jacks, patch cords, consolidation points, and patch panels shall be Category 6 components and channel compliant and/or meet and adhere to the below defined standards.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1. ANSI/TIA/EIA - 568-B.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, May, 2001.

2. ANSI/TIA/EIA - 568-B.2, Commercial Building Telecommunications Cabling Standard Part 3: Balanced Twisted-Pair Cabling Components, June, 2002.
3. ANSI/TIA/EIA - 568-B.2-1, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling.
4. ANSI/TIA/EIA - 568-B.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, May, 2001.
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
6. ANSI/TIA/EIA – 570-A, Residential Telecommunications Cabling Standard, October, 1999.
7. ANSI/TIA/EIA – 606 - A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
8. ANSI/TIA/EIA – 607, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
9. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
10. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 10th Edition, 2002
    a. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) – 2002.

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor is responsible for adherence of all codes, including local codes, and the authority having jurisdiction which may affect this project.

1.3 APPROVED CONTRACTOR

A. The Telecommunications contractor must have vendor approved and certified technicians that will install the cable system. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications Contractor is responsible for workmanship and installation practices in accordance with the specific vendor solution that is proposed.

1.4 APPROVED PRODUCTS

A. Products are specified in this document and on drawings for the horizontal and backbone systems. Specific product and item numbers are defined in later sections of this document or on drawings. The telecommunications drawings indicate the associated part number/equivalent. Product and item numbers are defined in later sections of this document or indicated on the drawings. Approved manufacturers are:

1. Leviton
2. Hubbell

1.5 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor; equipment, materials, supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish, install and terminate a complete communications infrastructure including wall plates, jacks patch panels, patch cords, cabinets and/or racks and any other material required to form a complete system.
2. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.
3. Furnish two (2) sets of test results of all cabling to the Owner/Owner's Representative on compact disk and paper format, listed by each closet, then by workstation ID.
4. Adhere and comply with all requirements of the manufacturer of the products proposed in this specification.
5. Provide owner orientation of the overall cable system and cable system documentation. (As-built drawings)

1.6 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:

1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this specification.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
3. Submit appropriate cut sheets for all products, hardware and cabling if different from the products that are called out in this specification.
    a. Work shall not proceed without the Owner/Owner's Representative approval of the submitted items.
    b. The telecommunications contractor must receive written approval from the Owner/Owner's Representative on all substitutions of material. Substituted materials shall not be installed except by written approval from the Owner/Owner's Representative.

1.7 QUALITY ASSURANCE

A. The telecommunications contractor shall be a company specializing in communication cabling installation. Building Industry Consulting Services International (BICSI), or the proposed system solution vendor, must certify 30 percent of the termination crew for copper and 10 percent of the termination crew for fiber with a Technicians Level of Training.

1.8 STORAGE AND HANDLING

A. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If necessary, cable shall be stored off site at the contractor's expense.

B. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner/Owner's Representative.

1.9 DRAWINGS

A. It shall be understood that the telecommunications details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The telecommunications contractor shall verify all dimensions and be responsible for there accuracy.

1.10 WARRANTY

A. The Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA–568-B.2.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.

B. The contractor shall provide a warranty on the physical installation of not less the one year at no cost to the owner. Information with regard to the proper procedures to follow if needed should be included with the warranty. They should include but not be limited to; Contact Name, Contact Telephone Number, Project Reference, Anticipated Response Time.

1.11 FINAL ACCEPTANCE & SYSTEM CERTIFICATION

A. Final Acceptance of the implemented cable system solution will be provided in writing from the Owner / Owner's Representative. It will be issued upon successful completion of the installation, including but not limited to, final inspections, receipt of the successful test results and as-built documentation, and successful performance of the cabling system for a thirty-day period. Upon successful completion of the installation and subsequent inspection, the Owner/Owner's Representative shall be provided with a numbered certificate, from the Manufacturer of the installed system solution. This Extended Product Warranty shall be provided within thirty days of the completion of the project. Final payment will not be made until such warranty / numbered certificate is received.

PART 2 – PRODUCTS

2.1 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate from the front.

B. The Telecommunications Outlet Assembly shall accommodate:

1. The number of jacks as noted on the project drawings.
2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
3. A blank filler module will be installed when extra ports are not used.
4. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Please refer to typical outlet configuration on project drawings prior to installation.

C. Printed labels shall be permanent and compliant with ANSI/TIA/EIA–606-B standard specifications. Labels shall be machine printed. Handwritten labels shall not be accepted.

1. Faceplates: The faceplates shall:
   a. be constructed of molded plastic.
   b. be UL listed and/or match the color of the raceway if installed in surface raceway.
   c. be available as single-gang or dual-gang and provide for easy access for moves, adds and changes.
   d. provide designation field to facilitate labeling and identification.
   e. comply with ANSI/TIA/EIA-606-A work area labeling standard.
   f. be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks

1. Data jacks shall be 8-position modular jacks and shall meet or exceed Category 6 performance standards as defined by the references in this document. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall be backwards compatible to Category 3, and 5.
3. The modular jack shall be center tuned to category 6 test specifications.

E. Video Jacks/Coax Connectors

1. Video jacks shall be “F” connectors and shall be installed in locations per the project drawing.

2.2 MODULAR PATCH PANELS

A. Modular Category 6 performance rated patch panels shall be used for the horizontal to terminate on. The panels shall be T568B standard, not high density, and use a standard 110-impact tool for termination.

B. 5E 66 blocks shall be used to terminate the voice cabling provided with bracket and wire spools.

2.3 WIRE MANAGEMENT PANELS

A. Cable management shall be provided above and below every 48 ports of patch / distribution panels or as shown on construction drawings. The wire management panels shall provide horizontal organization of patch cables on the rack.

B. Wire management panels shall also be required for every 48 ports of network electronics, (i.e. switches, hubs), installed in a rack.

2.4 RACKS

A. All equipment, patch panels, wiring blocks, etc., shall be mounted in self-supporting equipment as indicated on the project drawing. The rack shall be able to support 19" panels and equipment. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack, on both sides, for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack(s) shall be black in color to match the patch panels, ladder rack, and cable management. Provide 12" ladder rack at top of racks and secure properly with j-bolts to rack and angle bracket on wall. Refer to "Rack Detail" on drawings for specific information.

2.5 HORIZONTAL DISTRIBUTION CABLE

A. All horizontal voice/data cabling must be rated Category 6. The horizontal cable shall be terminated on Category 6 modular patch panels as specified on the drawings. The horizontal cable must pass all Category 6 testing parameters upon completion of installation and termination.

2.6 COAX CABLE

A. RG-6 Coax cable shall be installed to provide for video service within the facility. It shall run from the respective Telecommunications Room to specific locations as indicated on the project drawings

2.7 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the

recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded green insulated copper bonding conductor and compression connectors, or as shown on drawings.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Black insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.8 FIRESTOP

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

C. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).

PART 3 – EXECUTION

3.1 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12” of UTP and 36” of fiber slack shall be stored in an “in-wall” box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations, BICSI and best industry practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with recommendations from the manufacturer, BICSI and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points as noted on the project drawings. Additional splices, transition points or consolidation points must be approved in writing by the Owner / Owner's Representative.

E. Cables shall be routed to allow a minimum of three (3) feet of slack in a neat bundle, not coiled behind rack. This cable may be used for future rearrangements and re-terminations.

F. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

G. J-hook or trapeze system shall be used to support cable bundles. All horizontal cables shall be supported at a maximum of 48 inch intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels or any other type of ceiling. They also shall not rest on tops of walls, duct work, or piping.

H. Horizontal distribution cables shall be bundled in groups of not more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

K. Any cable damaged or exceeding recommended installation or test parameters during installation shall be replaced by the contractor before final acceptance at no cost to the Owner.

L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the outside diameter of the cable at any point in the run and at the termination field. The cable's minimum bend radius shall not be exceeded.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lb. for a four-pair UTP cable. The cables maximum pulling tension shall not be exceeded.

O. The installation of cable shall conform to the following clearances:

1. At 5 inches (127 millimeters) form power lines carrying 2KVA or less.
2. At least 12 inches (305 millimeters) from power lines carrying from 2 to 5 KVA.
3. At least 36 inches (915 millimeters) from power lines carrying more than 5 KVA.
4. At least 2 inches (305 millimeters) from all fluorescent lights and other sources of electromagnetic interference such as electric motors, HVAC equipment, arc welders, intercoms, etc.

3.3 HORIZONTAL CROSS CONNECT INSTALLATION

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's and BICSI recommendations, and best industry practices.

B. Cable pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained to within 25mm (1 inch) of the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

G. Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

H. Racks shall be placed as shown on the construction drawings. When possible they shall be placed with a minimum of 36-inch clearance from the walls on all sides.

I. All racks shall be grounded to the telecommunications ground bus bar.

J. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

K. Wall mounted termination block fields shall be mounted on 4’ x 8’ x .75” void free plywood. The plywood shall be mounted vertically 12” above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

3.4 FIRESTOP SYSTEM

A. All fire stop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for inspection by the local inspection authorities before cable system acceptance.

3.5 GROUNDING SYSTEM

A. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.
B. A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground.

3.6 IDENTIFICATION AND LABELING

A. Labeling shall be done as shown on construction drawings. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the red-lined as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

B. All label printing will be machine generated. Labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.7 TESTING AND ACCEPTANCE

A. General

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-B system solution guidelines. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through

couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed at no cost to the Owner.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, and the Manufacturer's Certification Program Information Manual, BICSI and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the Owner / Owner's Representative for clarification and resolution.
3. The Engineer may request that the T/C verify at random that the patch cords meet test requirements defined in ANSI/TIA/EIA-568-B.2.1.

B. Copper Link Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for category 6-performance compliance as specified in ANSI/TIA/EIA-568-B.2-1.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and/or replaced and re-tested before final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a Time Domain Reflectometer (TDR) type device. The cables shall be tested from end to end, patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

C. Category 6 Performance

1. Follow the Standards requirements established in:

   a. ANSI/TIA/EIA-568-B .1, B.2-1
   b. A Level III test unit is required to verify category 6 performance. The basic tests required are:
      - Wire Map
      - Length
      - Attenuation
      - NEXT (Near end crosstalk)
      - Return Loss
      - ELFEXT Loss
      - Propagation Delay
      - Delay skew
      - PSNEXT (Power sum near-end crosstalk loss)
      - PSELFEXT (Power sum equal level far-end crosstalk loss)

D. Coax Cable Testing

1. 100% of coax cables placed shall be tested. They shall be tested for continuity and length. The results shall be recorded and provided to the Engineer for review.

3.8 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide two (2) full documentation sets to the Owner / Owner's Representative for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test results and draft annotated drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. The telecommunications contractor shall provide copies of the original test results to the Owner / Owner's Representative.

C. The Owner / Owner's Representative may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Owner / Owner's Representative, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.9 TEST RESULTS

A. Test documentation shall be provided to the Owner / Owner's Representative within three weeks after the completion of the project. The telecommunications contractor shall provide one set of documentation, printed on paper and two copies on compact disk. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is mandatory on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-B including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the (wire or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (CD-ROM) and print out on paper.

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

END OF SECTION 271000

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ECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

C. Bait-Station System Installation Report: Include the following:

1. Location of areas and sites conducive to termite feeding and activity.
2. Plan drawing showing number and locations of bait stations.
3. Dated report for each monitoring and inspection occurrence, indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
4. Termiticide brand name and manufacturer.
5. Quantities of **termiticide** used.
6. Schedule of inspections for one year from date of Substantial Completion.

D. Sample Warranties: For special warranties.

1.4 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than **five** years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.2 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.

3. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

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SECTION 334600 - SUBDRAINAGE

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. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Geotextile filter fabrics.
2. Perforated-wall pipe and fittings.

1.4 QUALITY ASSURANCE

A. Delegated Design: Hydraulic calculations, engineering, and pipe sizing for foundation and retaining wall drainage systems shall be the responsibility of the design/build subcontractor or the Civil engineer of record.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 (DN 150) and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 (DN 200) and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.2 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling shall be specified on the Civil site improvements documents.

3.3 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches (150 mm) deep and 12 inches (300 mm) wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

J. Install drainage panels on foundation walls as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article.
3. Separate 4 inches (100 mm) of fabric at beginning of roll and cut away 4 inches (100 mm) of core. Wrap fabric around end of remaining core.
4. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.

K. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 RETAINING-WALL DRAINAGE INSTALLATION

A. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches (100 mm).

B. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

C. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

D. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.

E. Place drainage course in layers not exceeding 3 inches (75 mm) in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

F. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

G. Install drainage panels on wall as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
3. If weep holes are used instead of drainage pipe, cut 1/2-inch- (13-mm-) diameter holes on core side at weep-hole locations. Do not cut fabric.
4. Mark horizontal calk line on wall at a point 6 inches (150 mm) less than panel width above footing bottom. Before marking wall, subtract footing width.
5. Separate 4 inches (100 mm) of fabric at beginning of roll and cut away 4 inches (100 mm) of core. Wrap fabric around end of remaining core.
6. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches (50 to 150 mm) below top of panel, approximately 48 inches (1200 mm) apart. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
7. If another panel is required on same row, cut away 4 inches (100 mm) of installed panel core and wrap fabric over new panel.
8. If additional rows of panel are required, overlap lower panel with 4 inches (100 mm) of fabric.
9. Cut panel as necessary to keep top 12 inches (300 mm) below finish grade.
10. For inside corners, bend panel. For outside corners, cut core to provide 3 inches (75 mm) for overlap.

H. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.5 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches (150 mm) between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches (300 mm) of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches (915 mm) otherwise indicated.
2. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches (915 mm) unless otherwise indicated.
3. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm) unless otherwise indicated.
4. Lay perforated pipe with perforations down.
5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D2321.

3.7 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D3212 with loose banded, coupled, or push-on joints.

B. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.8 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."

B. Cleanouts for Foundation, Retaining-Wall and Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set top of cleanout flush with grade.
3. In nonvehicular-traffic areas, use NPS 4 (DN 100) PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) deep. Set top of cleanout 1 inch (25 mm) above grade.
4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."

3.9 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.10 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312000 "Earth Moving."

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

Appendix 1 – Proposed UL Design Assemblies

UL Index

		UL Design No.
Fire Wall Assemblies		
1. 2 Hour fire wall assembly	-	U347
Fire Barrier/Partition wall Assemblies		
1. 1 Hour wood exterior bearing wall assembly	-	U356
Head of Wall Assemblies		
1. 1 & 2 Hour rated assembly	-	HW-D-0088
Rated Wall Through-Penetration Assemblies		
1. 1 & 2 Hour rated nonmetallic pipe penetration assembly	-	W-L-2093
2. 1 & 2 Hour rated nonmetallic pipe penetration assembly	-	W-L-2101
3. 1 & 2 Hour rated cable penetration assembly	-	W-L-3001
4. 1 & 2 Hour rated cable bundle penetration assembly	-	W-L-3076
5. 1 & 2 Hour rated metallic pipe penetration assembly	-	W-L-5040
6. 1 & 2 Hour rated steel vent pipe penetration assembly	-	W-L-7019

UL DESIGN U347

FIRE-RESISTANCE DESIGN

Assembly Usage Disclaimer

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. U347

January 11, 2019

Nonbearing Wall Rating — 2 Hr (See Items 4, 4A and 4B) (Separation Wall, See Items 1,2 and 3)

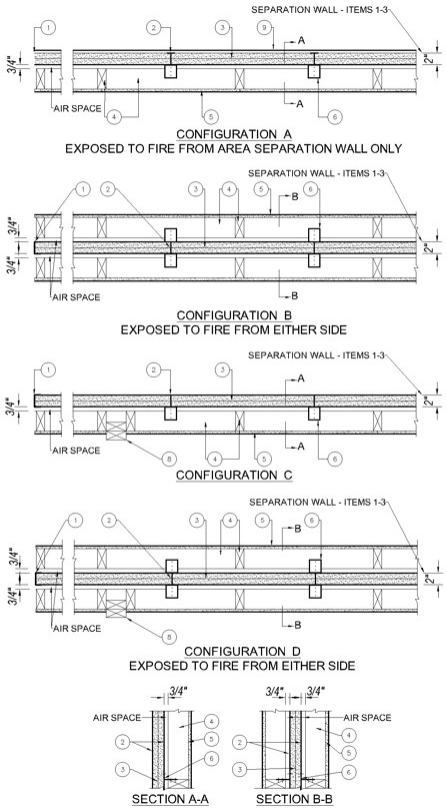
Bearing Wall Rating 2 Hr. (Protected Wall, See Items 4 and 4A)

Nonbearing Wall Rating 2-Hr (Protected Wall, See Item 4, 4A and 4B)

Finish Rating — 120 Min (See Item 4)

STC Ratings — 61, 69, 70 (See Items 7 - 7B)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



SEPARATION WALL: (Non-bearing, Max Height - 66 ft - see Item 6)

1. **Steel Track —** Floor, sidewall or top wall track. Nom 2 in. wide channel shaped with nom 1 in. long legs, formed from No. 25 MSG galv steel, secured with suitable fasteners spaced 24 in. OC.

2. **Steel Studs —** "H" shaped studs formed from No. 25 MSG galv steel having an overall depth of approximately 2 in. and flange width 1-3/8 in.

3. **Gypsum Board* —** Two layers of 1 in. thick gypsum wallboard liner panels, supplied in nom 24 in. widths. Vertical edges of panels friction fit into "H" shaped studs.
NATIONAL GYPSUM CO — Types FSW, FSW-B, FSW-7, FSW-9

PROTECTED WALL: (Bearing or Nonbearing Wall, as indicated in Items 4, 4A and 4B. When Bearing, Load Restricted for Canadian Applications — See Guide BXUV7.)

4. **Wood Studs —** For Bearing or Nonbearing Wall Rating — Nom 2 by 4 in. max spacing 24 in. OC. Studs cross braced at mid-height where necessary for clip attachment. Min 3/4 in. separation between wood framing and fire separation wall. Finish rating evaluated for wood studs only.

4A. **Steel Studs —** (As an alternate to Item 4, not shown) — For Bearing Wall Rating — Corrosion protected steel studs, min No. 20 MSG (0.0329 in., min bare metal thickness) steel or min 3- 1/2 in. wide, min No. 20 GSG (0.036 in. thick) galv steel or No. 20 MSG (0.033 in. thick) primed steel, cold formed, shall be designed in accordance with the current edition of the Specification for the Design of Cold-Formed Steel Structural Members by the American Iron and Steel Institute. All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies. The max stud spacing of wall assemblies shall not exceed 24 in. OC. Studs attached to floor and ceiling tracks with 1/2 in. long Type S-12 steel screws on both sides of studs or by welded or bolted connections designed in accordance with the AISI specifications. Top and bottom tracks shall consist of steel members, min No. 20 MSG (0.0329 in., min bare metal thickness) steel or min No. 20 GSG (0.036 in. thick) galv steel or No. 20 MSG (0.033 in. thick) primed steel, that provide a sound structural connection between steel studs, and to adjacent assemblies such as a floor, ceiling, and/or other walls. Attached to floor and ceiling assemblies with steel fasteners spaced not greater than 24 in. O.C. Studs cross-braced with stud framing at midheight where necessary for clip attachment. Min 3/4 in. separation between steel framing and area separation wall. Finish rating has not been evaluated for Steel Studs.

4B. **Steel Studs —** (As an alternate to Items 4 and 4A, for use in Configuration B only, not shown) — For Nonbearing Wall Rating — Channel shaped, fabricated from min 25 MSG corrosion-protected steel, min 3-1/2 in. wide, min 1-1/4 in. flanges and 1/4 in. return, spaced a max of 24 in. OC. Studs to be cut 3/8 to 3/4 in. less than assembly height. Top and bottom tracks shall be channel shaped, fabricated from min 25 MSG corrosion-protected steel, min width to accommodate stud size, with min 1 in. long legs, attached to floor and ceiling with fasteners 24 in. OC max. Studs cross-braced with stud framing at midheight where necessary for clip attachment. Min 3/4 in. separation between steel framing and area separation wall. Finish rating has not been evaluated for Steel Studs.

5. **Gypsum Board — Classified or Unclassified —** Min 1/2 in. thick, 4 ft wide, applied horizontally or vertically. Wallboard attached to wood studs (Item 4) with 1-1/4 in. long steel drywall screws spaced 12 in. OC. Wallboard attached to steel studs (Item 4A or 4B) with 1 in. long Type S steel screws spaced 12 in. OC. Vertical joints located over studs. Horizontal joints shall be butted tight to form a closed joint. As an option, joints covered with paper tape and joint compound. As an option, screw heads covered with joint compound.

5A. **Plywood Sheathing or OSB —** (not shown) — As an alternate to Item 5, Min 1/2 in. thick plywood or OSB applied horizontally or vertically to wood or steel studs. Vertical joints located over studs. Horizontal joints shall be butted tight to form a closed joint. Fastened to studs with nails or screws of sufficient length, spaced 12 in. OC. Joints and fastener heads are not required to be treated. Aluminum clips shall be spaced as described in Item 6.

5B. **Batts and Blankets* —** (not shown) — As an alternate to Items 5 and 5A, Glass fiber or mineral wool insulation, min. 3-1/2 in. thick, placed to completely fill the wood or steel stud cavities. When Batts and Blankets are used in place of Items 5 and 5A, the max height is 54 ft and the aluminum clips (Item 6) shall be spaced a max of 5 ft OC vertically. See Batts and Blankets (BKNV) category in the Building Materials Directory and Batts and Blankets (BZJZ) category in the Fire Resistance Directory for name of Classified Companies.

5C. **Wall and Partition Facings and Accessories* —** (not shown) — As an alternate to Items 5, 5A and 5B, 4 ft wide panels, applied vertically. Panels attached to wood studs (Item 4) with 1-5/8 in. long steel drywall screws spaced 16 in. OC. Vertical joints located over studs. Joints covered with paper tape and joint compound. As an option, screw heads covered with joint compound.
NATIONAL GYPSUM CO — Type SoundBreak Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types QuietRock QR-500, QuietRock QR-510, QuietRock QR-525

6. **Aluminum Clips —** Aluminum angle, 0.049 in. thick, 2 in. wide with 2 in. and 2-1/2 in. legs. Clips secured with Type S screws 3/8 in. long to "H" studs and with 1-1/4 in. long screws to wood framing or steel framing through holes provided in clip.

6A. Clip placement for separation walls up to 23 ft high: Space clips a max of 10 ft OC vertically between wood or steel framing and "H" studs.

6B. Clip placement for separation walls up to 54 ft high: Space clips as described in Item 6A for upper 24 ft. Remaining wall area below requires clips spaced a max of 5 ft OC vertically between wood or steel framing and "H" studs.

6C. Clip placement for separation walls up to 66 ft high: Space clips as described in Item 6A for upper 24 ft, space clips as described in Item 6B for middle 30 ft. Remaining wall area below requires clips spaced a max of 39 in. OC vertically between wood or steel framing and "H" studs.

7. **STC Rating —** The STC Rating of the wall assembly is 61 when it is constructed as described by Items 1 through 6, except:

A. Item 4, above — Wood Studs — Shall be spaced 16 in. OC.

B. Item 5, above — Gypsum Board — Min. weight 1.5 psf. Shall be applied vertically and attached to studs with 1-1/4 in. long steel drywall screws spaced 16 in. OC. Joints and screwheads shall be covered with paper tape and joint compound.

C. Item 6, above — Aluminum Clips — Spaced a max of 10 ft OC vertically.

D. Batts and Blankets* - The cavities formed by the wood studs shall be friction fit with 3-1/2 in. thick fiberglass insulation batts, min. 0.80 pcf. See Batts and Blankets (BKNV) category in the Building Materials Directory and Batts and Blankets (BZJZ) category in the Fire Resistance Directory for name of Classified Companies.

E. Max Height of Separation Wall is 23 ft.

F. The STC rating applies to Configuration B only.

G. Steel Studs (Items 4A, 4B), Plywood Sheathing or OSB (Item 5A and Item 9) and Batts and Blankets (Items 5B) not evaluated as alternatives for obtaining STC rating.

7A. **STC Rating —** The STC Rating of the wall assembly is 69 when it is constructed as described by Items 1 through 6, except:

A. Item 4, above — Wood Studs — Shall be spaced 16 in. OC.

B. Item 5C, above — Wall and Partition Facings and Accessories* — Type QuietRock QR-510 panels shall be installed.

C. Item 6, above — Aluminum Clips — Spaced a max of 10 ft OC vertically.

D. Batts and Blankets* - The cavities formed by the wood studs shall be friction fit with 3-1/2 in. thick fiberglass insulation batts, min. 1.0 pcf. See Batts and Blankets (BKNV) category in the Building Materials Directory and Batts and Blankets (BZJZ) category in the Fire Resistance Directory for name of Classified Companies.

E. Max Height of Separation Wall is 23 ft.

F. The STC rating applies to Configuration B only.

G. Steel Studs (Items 4A, 4B), Plywood Sheathing or OSB (Item 5A and Item 9) and Batts and Blankets (Items 5B) not evaluated as alternatives for obtaining STC rating.

7B. **STC Rating —** The STC Rating of the wall assembly is 70 when it is constructed as described by Items 1 through 6, except:

A. Item 4, above - Wood Studs - Shall be spaced 16 in. OC.

B. Item 5C, above - Wall and Partition Facings and Accessories* - Type QuietRock QR-525 panels shall be installed as described in Item 5C.

C. Item 6, above — Aluminum Clips - Spaced a max of 10 ft OC vertically.

D. Batts and Blankets* — The cavities formed by the wood studs shall be friction fit with 3-1/2 in. thick fiberglass insulation batts, min. 1.0 pcf. See Batts and Blankets (BKNV) category in the Building Materials Directory and Batts and Blankets (BZJZ) category in the Fire Resistance Directory for name of Classified Companies.

E. Max Height of Separation Wall is 23 ft.

F. The STC rating applies to Configuration B only.

G. Steel Studs (Items 4A, 4B), Plywood Sheathing or OSB (Item 5A and Item 9) and Batts and Blankets (Items 5B) not evaluated as alternatives for obtaining STC rating.

8. **Non-Bearing Wall Partition Intersection —** (Optional) Two nominal 2 by 4 in. stud or nominal 2 by 6 in. stud nailed together with two 3in. long 10d nails spaced a max. 16 in. OC. vertically and fastened to one side of the minimum 2 by 4 in. stud with 3 in. long 10d nails spaced a max 16 in. OC. vertically. Intersection between partition wood studs to be flush with the 2 by 4 in. studs. The wall partition wood studs are to be framed with a second 2 by 4 in. wood stud fastened with 3 in. long 10d nails spaced a max. 16 in. OC. vertically. Maximum one non-bearing wall partition intersection per stud cavity. Non-bearing wall partition stud depth shall be at a minimum equal to the depth of the wall.

9. **Plywood Sheathing or OSB —** (Optional) — Min 1/2 in. thick plywood or OSB applied horizontally or vertically to "H" studs on area separation wall side of Configuration A or Configuration C. Vertical joints located over studs. Fastened to "H" studs with screws of sufficient length, spaced a maximum of 12 in. OC.

10. **Gypsum Board* —** As an alternate to Item 5 - Min 5/8 in. thick, min. 6 in. wide batten strips, applied on both sides of Steel Studs (Item 2) and horizontal back to back Steel Track (Item 1). Min. 5/8 in. thick, min. 3 in. wide batten strips applied on both sides of single Steel Track (Item 1) at perimeter of assembly. Batten strips secured to studs with 1-1/4 in. long Type S steel screws spaced 12 in. OC. Batten joints shall be butted tight to form a closed joint. As an option, entire sheet of gypsum board may be used in lieu of the battens. Clip placement as in item 6, 6A, 6B, or 6C.
NATIONAL GYPSUM CO — Type FSW-3.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2019-01-11

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- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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BXUV.U356 - Fire-resistance Ratings - ANSI/UL 263

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BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. U356

October 07, 2020

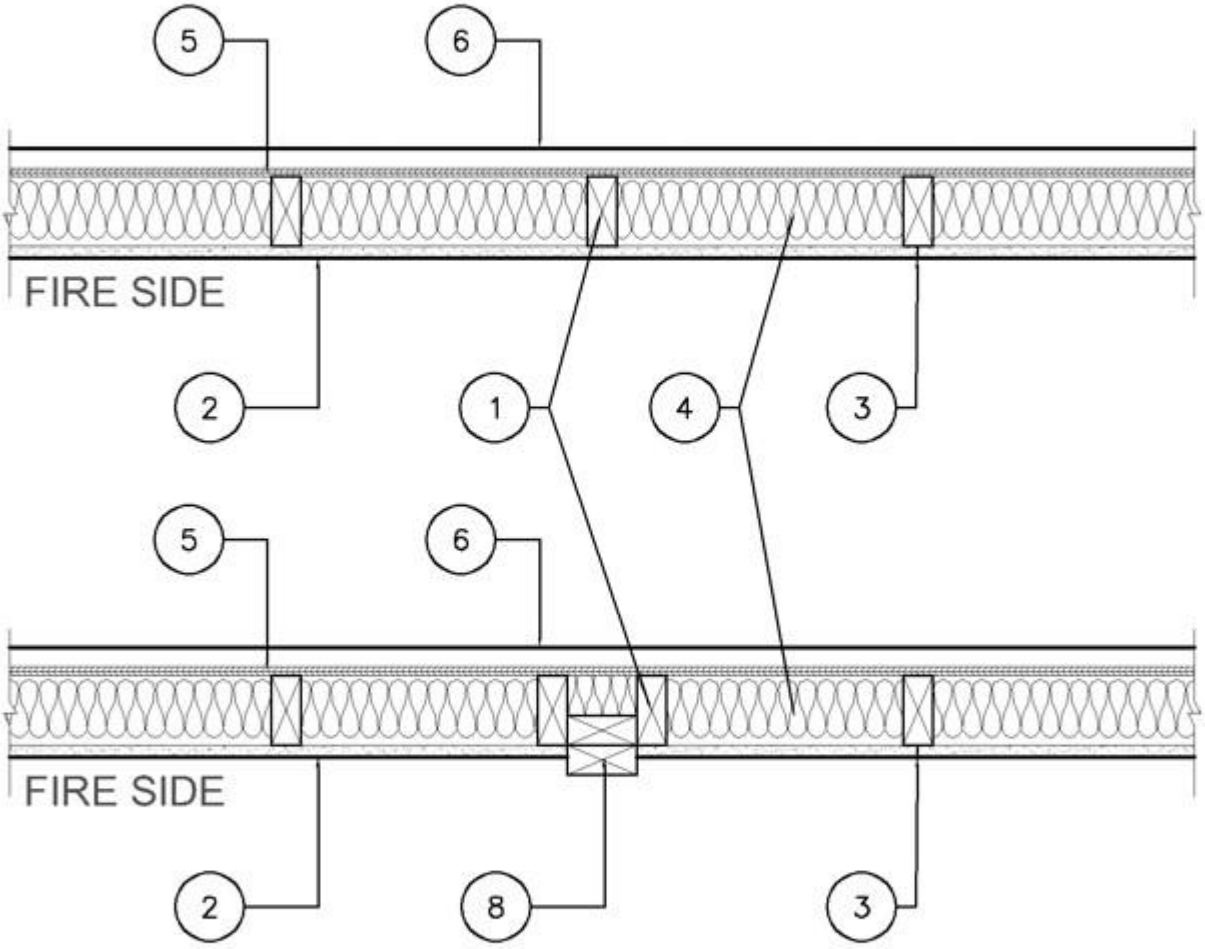
Bearing Wall Rating - 1 Hr Rating Exposed to Fire on Interior Face Only

Bearing Wall Rating — 1 Hr Rating Exposed to Fire on Exterior Face (See Item 6E)

Finish Rating — 23 Min or 25 Min (See Item 2C)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide BXUV or BXUV7

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Wood Studs —** Nom 2 by 4 in. spaced 16 in. OC with two 2 by 4 in. top and one 2 by 4 in. bottom plates. Studs laterally-braced by wood structural panel sheathing (Item 5). When **Mineral and Fiber Boards*** (Item 5A) are considered as bracing for the studs, the load is restricted to 76% of allowable axial load. Walls effectively fire stopped at top and bottom of wall.

2. **Gypsum Board* — Any 5/8 in. thick UL Classified Gypsum Board that is eligible for use in Design Nos. L501, G512 or U305.** Nom 5/8 in. thick, 4 ft wide, applied vertically and nailed to studs and bearing plates 7 in. OC with 6d cement-coated nails, 1-7/8 in. long with 1/4 in. diam head.

When Item **Steel Framing Members*** (Item 7 or any alternate clips), is used, gypsum panels attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When Item 7A **Steel Framing Members***, is used, two layers of gypsum panels attached to furring channels. Base layer attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC. Face layer attached to furring channels with 1-5/8 in. long Type S bugle-head steel screws spaced 12 in. OC. All joints in face layers staggered with joints in base layers.

AMERICAN GYPSUM CO (View Classification) — CKNX.R14196

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO (View Classification) — CKNX.R19374

CABOT MANUFACTURING ULC (View Classification) — CKNX.R25370

CERTAINTEED GYPSUM INC (View Classification) — CKNX.R3660

CGC INC (View Classification) — CKNX.R19751

CERTAINTEED GYPSUM INC (View Classification) — CKNX.R18482

GEORGIA-PACIFIC GYPSUM L L C (View Classification) — CKNX.R2717

LOADMASTER SYSTEMS INC (View Classification) — CKNX.R11809

NATIONAL GYPSUM CO (View Classification) — CKNX.R3501

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM (View Classification) — CKNX.R7094

PANEL REY S A (View Classification) — CKNX.R21796

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD (View Classification) — CKNX.R19262

THAI GYPSUM PRODUCTS PCL (View Classification) — CKNX.R27517

UNITED STATES GYPSUM CO (View Classification) — CKNX.R1319

USG BORAL DRYWALL SFZ LLC (View Classification) — CKNX.R38438

USG MEXICO S A DE C V (View Classification) — CKNX.R16089

2A. **Gypsum Board* —** (As an alternate to Item 2, Not Shown) — Any 5/8 in. thick 4 ft wide gypsum panels that are eligible for use in Design Nos. L501, G512 or U305, supplied by the Classified Companies listed below shown in the **Gypsum Board*** (CKNX) category. Applied vertically and attached to studs and bearing plates with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board.

CGC INC

UNITED STATES GYPSUM CO

USG BORAL DRYWALL SFZ LLC

USG MEXICO S A DE C V

2B. **Gypsum Board* —** (As an alternate to Item 2, Not Shown) — 5/8 in. thick 4 ft wide gypsum panels applied vertically and attached to studs and bearing plates with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, LightRoc

CABOT MANUFACTURING ULC — Type X, 5/8 Type X, Type Blueglass Exterior Sheathing

CERTAINTEED GYPSUM INC — Type C, Type X, Type X-1, Easi-Lite Type X-2

GEORGIA-PACIFIC GYPSUM L L C — Types X, Veneer Plaster Base-Type X, Water Rated-Type X, Sheathing Type-X, Soffit-Type X, Type X ComfortGuard Sound Deadening Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types PG-11, PGS-WRS, PGI.

THAI GYPSUM PRODUCTS PCL — Type C or Type X

2C. **Gypsum Board* —** (As an alternate to Item 2, Not Shown) — For Use with Item 5A only - 5/8 in. thick 4 ft wide gypsum panels applied horizontally and attached to studs and bearing plates with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screws 1 in.and 4 in. from edges of board. Finish Rating is 25 min.
CABOT MANUFACTURING ULC — 5/8 Type X, Type Blueglass Exterior Sheathing

GEORGIA-PACIFIC GYPSUM L L C — Type X, Veneer Plaster Base-Type X, Water Rated-Type X, Sheathing Type-X, Soffit-Type X

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types PG-11, PGS-WRS, PGI

2D. **Gypsum Board* —** (As an alternate to Item 2) — Not to be used with item 7. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically only and fastened to the studs and plates with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads, 7 in. OC.
NATIONAL GYPSUM CO — Type SBWB

2E **Gypsum Board* —** (As an alternate to Items 2 through 2D) — Nominal 5/8 in. thick, 4 ft wide panels, secured as described in Item 2.
PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock ES.

2F. **Gypsum Board* —** (As an alternate to Item 2) — Not to be used with item 7. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically or horizontally and fastened to the studs and plates with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board.
CERTAINTEED GYPSUM INC — Type SilentFX

2G. **Wall and Partition Facings and Accessories* —** (As an alternate to Items 2 through 2F) — Nominal 5/8 in. thick, 4 ft wide panels, secured as described in Item 2.
PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527.

2H. **Gypsum Board* —** (As an alternate to Item 2) — 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a maximum 10 in. OC with the last two screws 4 and 1 in. from the edges of the board. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

CERTAINTEED GYPSUM INC — Type LGFC6A (finish rating 21 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

2I. **Gypsum Board* —** (As an alternate to Item 2) — 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 8 in. OC, with last screw 1 in. from edge of board. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.
AMERICAN GYPSUM CO — Types AGX-1 (finish rating 25 min.), M-Glass (finish rating 25 min.), AG-C (finish rating 25 min.), LightRoc (finish rating 25 min.)

NATIONAL GYPSUM CO — Type FSK, Type FSK-G, Type FSW, Type FSW-3, Type FSW-5, Type FSW-G, Type FSK-C, Type FSW-C, Type FSMR-C, Type FSW-6, Type FSL

2J. **Gypsum Board* —** (As an alternate to Item 2) - 5/8 in. thick gypsum panels, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels fastened to framing with 1-1/4 in. long Type W coarse thread steel screws spaced a max 8 in. OC with the last screw 1 in. from edge of board. When used in widths other than 48 in., gypsum boards are to be installed horizontally.
CERTAINTEED GYPSUM INC — Type C, Type X or Type X-1(finish rating 26 min), Easi-Lite Type X (finish rating 24 min), Easi-Lite Type X-2, Type EGRG or GlasRoc or GlasRoc Sheathing (finish rating 23 min)

3. **Joints and Fastener Heads —** (Not Shown) — Gypsum board joints covered with tape and joint compound. Fastener heads covered with joint compound.

4. **Batts and Blankets* —** Mineral fiber or glass fiber insulation, 3-1/2 in. thick, pressure fit to fill wall cavities between studs and plates. Mineral fiber insulation to be unfaced and to have a min density of 3 pcf. Glass fiber insulation to be faced with aluminum foil or kraft paper and to have a min density of 0.9 pcf (min R-13 thermal insulation rating).

See **Batts and Blankets*** (BKNV) Category in the Building Materials Directory and **Batts and Blankets*** (BZJZ) Category in the Fire Resistance Directory for names of Classified Companies.

4A. **Fiber, Sprayed* —** As an alternate to Batts and Blankets (Item 4) — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product with a nominal dry density of 2.7 lb/ft^3. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft^3, in accordance with the application instructions supplied with the product.
U S GREENFIBER L L C — INS735 and INS745 for use with wet or dry application. INS515LD, INS541LD, INS735, INS745, INS765LD, and INS773LD are to be used for dry application only.

4B. **Fiber, Sprayed* —** As an alternate to Item 4 and 4A — Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 4.58 lb/ft ^{3}.
NU-WOOL CO INC — Cellulose Insulation

4C. **Fiber, Sprayed* —** As an alternate to Batts and Blankets (Item 4) — Spray applied cellulose fiber. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. The minimum dry density shall be 4.30 lbs/ft^3.
INTERNATIONAL CELLULOSE CORP — Celbar-RL

4D. **Fiber, Sprayed* —** As an alternate to Batts and Blankets (Item 4) — Spray applied, granulated mineral fiber material. The fiber is applied with adhesive, at a minimum density of 4.0 pcf, to completely fill the enclosed cavity in accordance with the

application instructions supplied with the product. See Fiber, Sprayed (CCAZ).
AMERICAN ROCKWOOL MANUFACTURING, LLC — Type Rockwool Premium Plus

5. **Wood Structural Panel Sheathing —** Min 7/16 in. thick, 4 ft wide wood structural panels, min grade "C-D" or "Sheathing". Installed with long dimension of sheet (strength axis) or face grain of plywood parallel with or perpendicular to studs. Vertical joints centered on studs. Horizontal joints backed with nom 2 by 4 in. wood blocking. Attached to studs on exterior side of wall with 6d cement coated box nails spaced 6 in. OC at perimeter of panels and 12 in. OC along interior studs.

5A. **Mineral and Fiber Boards* —** As an alternate to Item 5 - Min 1/2 in. thick, 4 ft wide sheathing, installed vertically to studs. Vertical joints centered on studs. Horizontal joints backed with nom 2 by 4 in. wood blocking. Attached to studs on exterior side of wall with 1-1/2 in. long galvanized roofing nails spaced 6 in. OC at perimeter of panels and 12 in. OC along interior studs. As an option a weather resistive barrier may be applied over the Mineral and Fiber Boards.

6. **Exterior Facings —** Installed in accordance with the manufacturer's installation instructions. One of the following exterior facings is to be applied over the sheathing:

A. **Vinyl Siding — Molded Plastic* —** Contoured rigid vinyl siding having a flame spread value of 20 or less.
See **Molded Plastic** (BTAT) category in the Building Materials Directory for names of manufacturers.

B. **Particle Board Siding —** Hardboard exterior sidings including patterned panel or lap siding.

C. **Wood Structural Panel or Lap Siding —** APA Rated Siding, Exterior, plywood, OSB or composite panels with veneer faces and structural wood core, per PS 1 or APA Standard PRP-108, including textured, rough sawn, medium density overlay, brushed, grooved and lap siding.

D. **Cementitious Stucco —** Portland cement or synthetic stucco systems with self-furring metal lath or adhesive base coat. Thickness from 3/8 to 3/4 in., depending on system.

E. **Brick Veneer —** Any type on nom 4 in. wide brick veneer. When brick veneer is used, the rating is applicable with exposure on either face. Brick veneer fastened with corrugated metal wall ties attached over sheathing to wood studs with 8d nail per tie: ties spaced not more than each sixth course of brick and max 32 in. OC horizontally. One in. air space provided between brick veneer and sheathing.

F. **Exterior Insulation and Finish System (EIFS) —** Nom 1 in. **Foamed Plastic*** insulation bearing the UL Classification Marking, attached over sheathing and finished with coating system, or Portland cement or synthetic stucco systems, in accordance with manufacturer's instructions. See **Foamed Plastic** (BRYX and CCVW) categories for names of Classified companies.

G. **Siding —** Aluminum or steel siding attached over sheathing to studs.

H. **Fiber-Cement Siding —** Fiber-cement exterior sidings including smooth and patterned panel or lap siding.

I. **Wall and Partition Facings and Accessories* —** Stone veneer is mortar bonded to a lath, scratch coat and water resistant barrier applied to sheathing, installed in accordance with the manufacturers installation instructions, and meeting the requirements of local code agencies.
ELDORADO STONE OPERATIONS L L C — Type Eldorado Stone

J. **Cementitious Backer Units —** 1/2 in. or 5/8 in., min. 32 in. wide.- Applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with cement board screws of adequate length to penetrate stud by a minimum 3/4 in., spaced a max of 8 in. OC. Horizontal joints need not be backed by framing. When Cementitious Backer Units are used, the rating is applicable with exposure on either face. Cementitious Backer Units for use as substrate for exterior finishes such as ceramic tile, slate, marble, natural stone, manufactured stone, thin brick, or Portland cement or synthetic stucco.

NATIONAL GYPSUM CO — Type PermaBase

6A. **Building Units* — As an alternate to Exterior Facing Item 6 —** Insulated steel panels, 12 through 42 in. wide. Attached over sheathing through retainer clips to studs or support steel with No. 14 hex head self-tapping screws located at each joint in the concealed lip of the units and spaced in accordance with the structural design requirements. KINGSPAN INSULATED PANELS INC — Types 200, 300, 400, 900, or KS series, 2 through 6 in. thickness; CWP-V, H, 2 through 3 in. nominal thickness or Designwall 2000 or Designwall 4000, 2 and 3 in. nominal thickness.

7. **Steel Framing Members* —** (Optional, Not Shown) — Furring Channels and Steel Framing Members as described below:

a. **Furring Channels —** Formed of No. 25 MSG galv steel. 2-9/16 in. or 2-23/32 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach furring channels (Item 7A) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips. RSIC-1 clip for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) clip for use with 2-23/32 in. wide furring channels.
PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-1 (2.75).

7A. **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels —** Formed of No. 25 MSG galv steel, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Two layers of gypsum board attached to furring channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach furring channels (Item 7Aa) to interior side of studs. Clips spaced 48 in. OC., and secured to studs with two No. 8 x 2-1/2 in. coarse drywall screws, one through the hole at each end of the clip. Furring channels are friction fitted into clips.
KINETICS NOISE CONTROL INC — Type Isomax.

7B. **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels —** Formed of No. 25 MSG galv steel. 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach furring channels (Item a) to studs. Clips spaced 48 in. OC. Genie clips secured to studs with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.
PLITEQ INC — Type Genie Clip

7C. **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels —** Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire.Gypsum board attached to furring channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach furring channels (Item 7Ca) to studs. Clips spaced 48 in. OC., and secured to studs with 2 in. coarse drywall screw with 1 in. diam washer through the center hole. Furring channels are friction fitted into clips.
STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237R

7D. **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Furring channels and Steel Framing Members as described below:

a. **Furring Channels —** Formed of No. 25 MSG galv steel. Spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item 7Db. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire. Gypsum board attached to furring channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach furring channels (Item 7Da) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.
REGUPOL AMERICA — Type SonusClip

7E. **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Resilient channels and Steel Framing Members as described below:

a. **Resilient Channels —** Formed of No. 25 MSG galv steel, spaced 24 in. OC, and perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels overlapped 6 in. and secured in place with two No. 8 15 x 1/2 in. Philips Modified Truss screws spaced 2-1/2 in. from the center of the overlap. Gypsum board attached to resilient channels as described in Item 2.

b. **Steel Framing Members* —** Used to attach resilient channels (Item 7Ea) to studs. Clips spaced 48 in. OC., and secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Resilient channels are secured to clips with one No. 10 x 1/2 in. pan-head self-drilling screw.
KEENE BUILDING PRODUCTS CO INC — Type RC+ Assurance Clip

7F **Steel Framing Members* —** (Optional, Not Shown, As an alternate to Item 7) — Furring channels and Steel Framing Members as described below:

a **Furring Channels —** Formed of No. 25 MSG galv steel. 2-23/32 in. wide by 7/8 in. or 1-1/2 in. deep, spaced 24 in. OC perpendicular to studs. Channels secured to studs as described in Item b. Ends of adjoining channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping #6 framing screws, min. 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Gypsum board attached to furring channels as described in Item 2.

b **Steel Framing Members* —** Used to attach furring channels (Item 7Fa) to studs. Clips spaced maximum 48 in. OC. Clips secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips.

CLARKDIETRICH BUILDING SYSTEMS — Type ClarkDietrich Sound Clip

8. **Non-Bearing Wall Partition Intersection —** (Optional) — Two nominal 2 by 4 in. stud or nominal 2 by 6 in. stud nailed together with two 3in. long 10d nails spaced a max. 16 in. OC. vertically and fastened to one side of the minimum 2 by 4 in. stud with 3 in. long 10d nails spaced a max 16 in. OC. vertically. Intersection between partition wood studs to be flush with the

2 by 4 in. studs. The wall partition wood studs are to be framed by with a second 2 by 4 in. wood stud fastened with 3 in. long 10d nails spaced a max. 16 in. OC. vertically. Maximum one non-bearing wall partition intersection per stud cavity. Non-bearing wall partition stud depth shall be at a minimum equal to the depth of the bearing wall.

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Last Updated on 2020-10-07

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UL DESIGN HW-D-0088

ONLINE CERTIFICATIONS DIRECTORY

System No. HW-D-0088
XHBN.HW-D-0088
Joint Systems

Page Bottom

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

XHBN - Joint Systems

XHBN7 - Joint Systems Certified for Canada

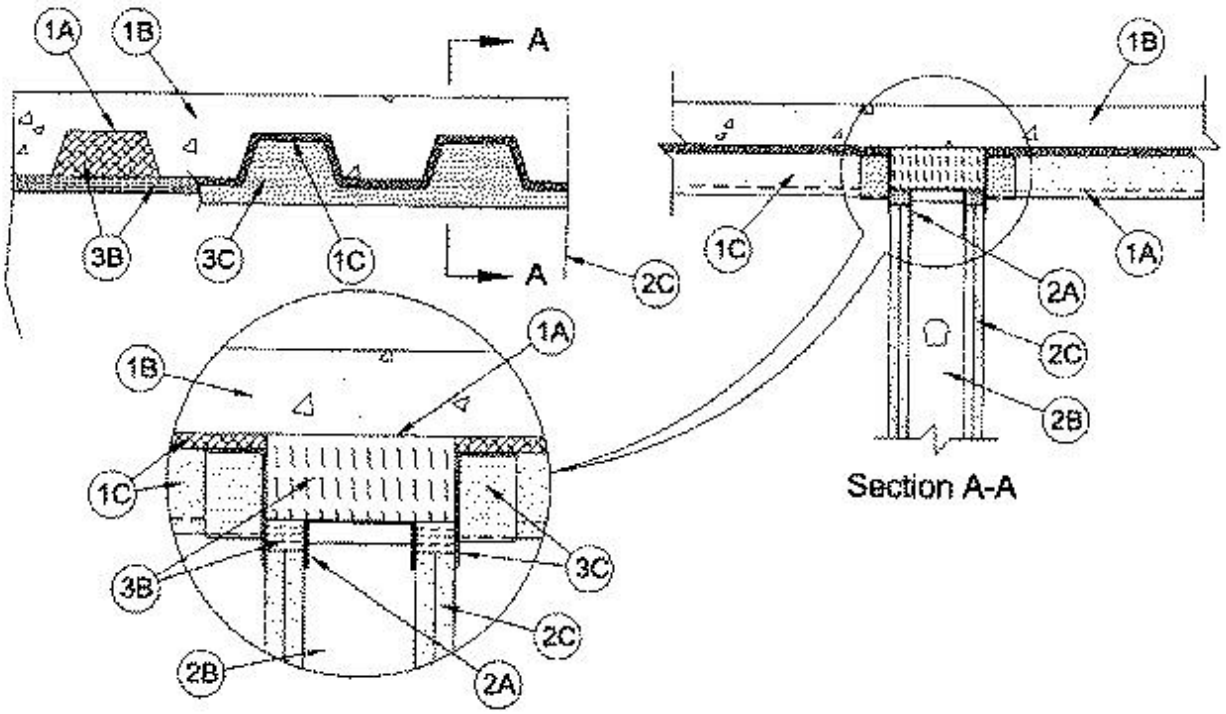
See General Information for Joint Systems

See General Information for Joint Systems Certified for Canada

System No. HW-D-0088

September 01, 2016

ANSI/UL2079	CAN/ULC S115
Assembly Rating — 1 and 2 Hr (See Item 2)	F Rating — 1 and 2 Hr (See Item 2)
Nominal Joint Width — 1 In.	FT Rating — 1 and 2 Hr (See Item 2)
Class II or III Movement Capabilities — 19% Compression or Extension	FH Rating — 1 and 2 Hr (See Item 2)
L Rating At Ambient — Less Than 1 CFM/lin ft	FTH Rating — 1 and 2 Hr (See Item 2)
L Rating At 400 F — Less Than 1 CFM/lin ft	Nominal Joint Width — 25 mm
	Class II or III Movement Capabilities — 19% Compression or Extension
	L Rating At Ambient — Less Than 1 CFM/lin ft
	L Rating At 400 F — Less Than 1 CFM/lin ft



1. **Floor Assembly —** The fire-rated fluted steel deck/concrete floor assembly shall be constructed of the materials and in the manner described in the individual D700 or D800 Series Floor-Ceiling Design in the UL Fire Resistance Directory and shall include the following construction features:

A. **Steel Floor and Form Units* —** Max 3 in. (76 mm) deep galv steel fluted floor units.

B. **Concrete —** Min 2-1/2 in. (64 mm) thick reinforced concrete, as measured from the top plane of the floor units.

C. **Spray-Applied Fire Resistive Material* —** After installation of the ceiling runner (Item 2A) or deflection track (Item 3A, if used), steel floor units to be sprayed with a min 5/16 in. (8 mm) to max 11/16 in. (18 mm) thickness of material in accordance with the specifications in the individual D700 or D800 Series Design. Material is to be excluded from the steel deck in the area immediately above the wall as well as from the flanges of the ceiling runner or deflection track.

ISOLATEK INTERNATIONAL — Type 300, Type II

GCP APPLIED TECHNOLOGIES INC — Type MK-6/HY

1A. **Roof Assembly —** (Not Shown) — As an alternate to the floor assembly (Item 1), a fire rated fluted steel deck roof assembly may be used. The roof assembly shall be constructed of the materials and in the manner described in the individual P700 or P800 Series Roof-Ceiling Design in the UL Fire Resistance Directory. The hourly fire rating of the roof assembly shall be equal to or greater than the hourly fire rating of the wall assembly. The roof assembly shall include the following construction features:

A. **Steel Roof Deck —** Max 3 in. (76 mm) deep galv steel fluted roof deck.

B. **Roof Insulation — Mineral and Fiber Board* —** Min 3/4 in. (19 mm) thick boards applied in one or more layers directly over steel roof deck or over gypsum board sheathing laid atop steel roof deck.

C. **Roof Covering* —** Hot-mopped or cold-application materials compatible with mineral and fiber board insulation.

D. **Spray-Applied Fire Resistive Material* —** After installation of the ceiling runner (Item 2A) or deflection track (Item 3A, if used), steel roof deck to be sprayed with a max 3/4 in. (19 mm) thickness of spray applied fire resistive material as specified in the individual P700 or P800 Series Roof-Ceiling design. Material is to be excluded from the steel deck in the area immediately above the wall as well as from the flanges of the ceiling runner or deflection track.

ISOLATEK INTERNATIONAL — Type 300, Type II

GCP APPLIED TECHNOLOGIES INC — Type MK-6/HY

2. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. **Steel Floor and Ceiling Runners —** Floor and ceiling runners of wall assembly shall consist of galv steel channels sized to accommodate steel studs . Ceiling runner to be provided with min 1-1/4 in. (32 mm) to max 2 in. (51 mm) flanges. When deflection channel (Item 3A) is used, flange height of ceiling runner is to be equal to or greater than flange height of deflection channel and the ceiling runner is to nest within the deflection channel with a 1/2 in. (13 mm) to 3/4 in. (19 mm) gap maintained between the top of the ceiling runner and the top of the deflection channel. When deflection channel is not used, ceiling runner installed perpendicular to direction of fluted steel deck prior to the application of spray-applied fire resistive material and secured to valleys with steel masonry anchors or welds spaced max 24 in. (610 mm) OC.

A1. **Light Gauge Framing* — Slotted Ceiling Runner —** As an alternate to the ceiling runner in Item 2A, ceiling runner to consist of galv steel channel with slotted flanges sized to accommodate steel studs (Items 2B). Slotted ceiling runner installed perpendicular to direction of fluted steel deck prior to the application of spray-applied fire resistive material and secured to valleys with steel masonry anchors spaced max 24 in. (610 mm) OC. When slotted ceiling runner is used, deflection channel (Item 3A) shall not be used.

BRADY CONSTRUCTION INNOVATIONS INC, DBA SLIPTRACK SYSTEMS — SLP-TRK

CALIFORNIA EXPANDED METAL PRODUCTS CO — CST

CLARKDIETRICH BUILDING SYSTEMS — Type SLT, SLT-H

MARINO/WARE, DIV OF WARE INDUSTRIES INC — Type SLT

METAL-LITE INC — The System

QUAIL RUN BUILDING MATERIALS INC — Slotted Deflection Track

RAM SALES L L C — RAM Slotted Track

SCAFCO STEEL STUD MANUFACTURING CO

STEELER INC — Steeler Slotted Ceiling Runner

TELLING INDUSTRIES L L C — True-Action Deflection Track

THE STEEL NETWORK INC — VertiTrack VT, series,250VT, 362VT, 400VT, 600VT and 800VT

A2. **Light Gauge Framing* - Notched Ceiling Runner —** As an alternate to the ceiling runners in Items 2A through 2A2, notched ceiling runners to consist of C-shaped galv steel channel with notched return flanges sized to accommodate steel studs (Item 2B). Notched ceiling runner installed perpendicular to direction of fluted steel floor deck prior to the application of spray-applied fire resistive material and secured to valleys with steel masonry anchors spaced max 24 in. OC. When notched ceiling runner is used, deflection channel (Item 3A) shall not be used.

OLMAR SUPPLY INC — Type SCR

B. **Studs —** Steel studs to be min 3-1/2 in. (89 mm) wide. Studs cut 1/2 in. (13 mm) to 3/4 in. (19 mm) less in length than assembly height with bottom nesting in and secured to floor runner. When slotted ceiling runner (Item 2A1) is used, steel studs secured to slotted ceiling runner with No. 8 by 1/2 in. (13 mm) long wafer head steel screws at midheight of slot on each side of wall. When deflection channel (Item 3A) is used, steel studs attached to ceiling runner with sheet metal screws located 1/2 in. (13 mm) below the bottom of the deflection channel. When deflection channel is not used, studs to nest in ceiling runner without attachment. Stud spacing not to exceed 24 in. (610 mm) OC.

B1. **Light Gauge Framing* —Slotted Studs —** Slotted steel stud to be used in conjunction with **Light Gauge Framing* —Floor and Ceiling Runners** (Item 2A1). Slotted steel studs to be min 3-1/2 in. (89 mm) wide. Slotted steel studs cut 1/2 in. to 3/4 in. (13 to 19 mm) less in

length than assembly height with bottom nesting in and secured to both ceiling and floor runners. Ceiling runner secured to preformed slot within steel stud by means of No. 10 by 3/4 in. (19 mm) long low profile head steel screw. Floor runner attached to bottom of steel stud by means of No. 8 by 1/2 in. (13 mm) long pan head steel screw. Slotted steel stud spacing not to exceed 24 in. (610 mm) OC.

STEELER INC — Steeler Slotted Stud

C. **Gypsum Board* —** Gypsum board sheets installed to a min total 5/8 in. (16 mm) or 1-1/4 in. (32 mm) thickness on each side of wall for 1 and 2 hr fire rated assemblies, respectively. Wall to be constructed in the individual U400 Series Design in the UL Fire Resistance Directory, except that a max 1 in. (25 mm) gap shall be maintained between the top of the gypsum board and the bottom surface of the steel floor or roof deck. The screws attaching the gypsum board to the studs along the top of the wall shall be located 1 in. (25 mm) below the bottom of the ceiling runner. No gypsum board attachment screws shall be driven into the ceiling runner or into the optional deflection channel.

The hourly fire rating of the joint system is equal to the hourly fire rating of the wall.

3. **Joint System — Max separation between bottom of floor or roof deck and top of gypsum board (at time of installation of joint system) is 1 in. (25 mm). The joint system is designed to accommodate a max 18.75 percent compression or extension from its installed width.** The joint system shall consist of forming and fill materials, with or without a deflection channel (Item 2A), as follows:

A. **Deflection Channel —** (Optional, Not Shown) — Max 2 in. (51 mm) deep min 24 gauge galv steel channel sized to accommodate ceiling runner (Item 2A). Deflection channel installed perpendicular to direction of fluted steel deck prior to the application of spray-applied fire resistive material and secured to steel floor or roof deck valleys with steel masonry anchors fasteners or welds spaced max 24 in. (610 mm) OC. The ceiling runner is installed within the deflection channel to maintain a 1/2 in. (13 mm) to 3/4 in. (19 mm) gap between the top of the ceiling runner and the top of the deflection channel. The ceiling runner nests inside the deflection channel without attachment.

B. **Forming Material* —** Min 5-5/8 in. (143 mm) or 7 in. (178 mm) thickness of 4 pcf (64 kg/m^3) mineral wool batt insulation for 1 and 2 hr fire rated assemblies, respectively, cut to the shape of the fluted deck and installed into the flutes of the steel floor or roof deck between the top of the deflection channel and the steel floor or roof deck. The mineral wool batt insulation is to be compressed min 14.3 percent in thickness such that it is flush with the gypsum board surface on both sides of the wall. Additional sections of mineral wool batt insulation are compressed 50 percent in thickness and installed cut edge first to completely fill the gap above the top of the gypsum board. The forming material shall be installed flush with both surfaces of wall.

INDUSTRIAL INSULATION GROUP L L C — MinWool-1200 Safing

ROCK WOOL MANUFACTURING CO — Delta Board

ROCKWOOL MALAYSIA SDN BHD — SAFE

ROXUL INC — SAFE

THERMAFIBER INC — Type SAF

B1. **Forming Material* —** (Optional, Not Shown) - Preformed mineral wool plugs, formed to the shape of the fluted floor units, friction fit to completely fill the flutes above the ceiling channel. The plugs shall project beyond each side of the ceiling runner and shall be recessed from both wall surfaces to accommodate the required thickness of fill material (Item 3C). Additional forming material, described in Item 3B, to be used in conjunction with the plugs to fill the gap between the top of gypsum board and bottom of steel deck.

THERMAFIBER INC — TopStop mineral wool deck plugs Type SAF batts

C. **Fill, Void or Cavity Material*-Sealant —** Min 1/8 in. (3.2 mm) wet thickness or 1/16 in. (1.6 mm) dry thickness of fill material spray applied on each side of the wall in the flutes of the steel floor or roof deck and between the top of the wall and the bottom of the steel floor or roof deck and overlap a min 1/2 in. (13 mm) onto gypsum board and a min 2 in. (51 mm) onto the spray applied material on both sides of wall.

SPECIFIED TECHNOLOGIES INC — SpecSeal AS200 Elastomeric Spray

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2016-09-01

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UL DESIGN W-L-2093

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

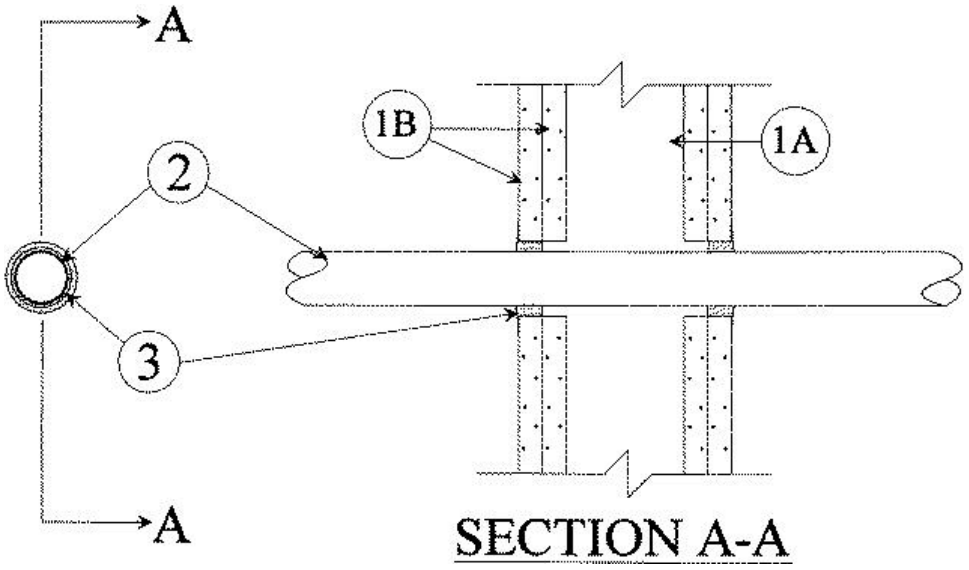
See General Information for Through-penetration Firestop Systems

System No. W-L-2093

December 09, 2008

F Ratings — 1 & 2 Hr. (See Item 1)

T Ratings — 1 and 1-1/2 Hr.(See Item 2)



1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. O.C. with nom 2 by 4 in. lumber end plates and cross braces. Steel studs to be min 3-5/8 in. wide and spaced max 24 in. O.C.

B. **Gypsum Board* —** 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 3 in.
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Through Penetrants —** One nonmetallic pipe, conduit or raceway to be centered within the firestop system. A nom annular space of 5/16 in. is required within the firestop system. Pipe, conduit or raceway to be rigidly supported on both sides of the floor or wall assembly. The following types and sizes of nonmetallic pipes, conduits or raceway may be used:

A. **Polyvinyl Chloride (PVC) Pipe —** Nom 2 in. diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) piping systems.

B. **Rigid Nonmetallic Conduit+ —** Nom 2 in. diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code (NFPA No. 70).

C. **Chlorinated Polyvinyl Chloride (CPVC) Pipe —** Nom 2 in. diam (or smaller) SDR17 CPVC pipe for use in closed (process or supply) piping systems.

D. **Optical Fiber Raceway+ —** Nom 2 in. diam (or smaller) optical fiber raceway formed from polyvinyl chloride (PVC) or nom 1-1/4 in. diam (or smaller) optical fiber raceway formed from polyvinylidene fluoride (PVDF). Raceway to be installed in accordance with Article No. 770 of the National Electrical Code. Raceway to be rigidly supported on both sides of wall assembly.
See Optical Fiber Raceway (QAZM) category in the Electrical Construction Materials Directory for names of manufacturers.

E. **Electrical Nonmetallic Tubing+ —** Nom 2 in. diam (or smaller) PVC tubing installed in accordance with Article 331 of the National Electrical Code (NFPA No. 70). See **Electrical Nonmetallic Tubing** (FKHU) category in the Electrical Construction Materials Directory for names of manufacturers.
The hourly T Rating of the firestop system is dependent upon the hourly fire rating of the wall and the diam of the through-penetrant as shown below:

Wall Hr	Max Diam of Through Penetrant In.	T Rating Hr
1	2	1
1	1-1/4	1
2	2	1
2	1-1/4	1-1/2

3. **Fill, Void or Cavity Material* — Sealant —** Min 5/8 in. thickness of fill material applied within annulus, flush with both surfaces of wall. Additional fill material to be installed such that a min 1/4 in. thick crown is formed around the penetrating item and lapping 1 in. beyond the periphery of the opening.
SPECIFIED TECHNOLOGIES INC — SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

+Bearing the UL Listing Mark

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2008-12-09

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- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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UL DESIGN W-L-2101

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

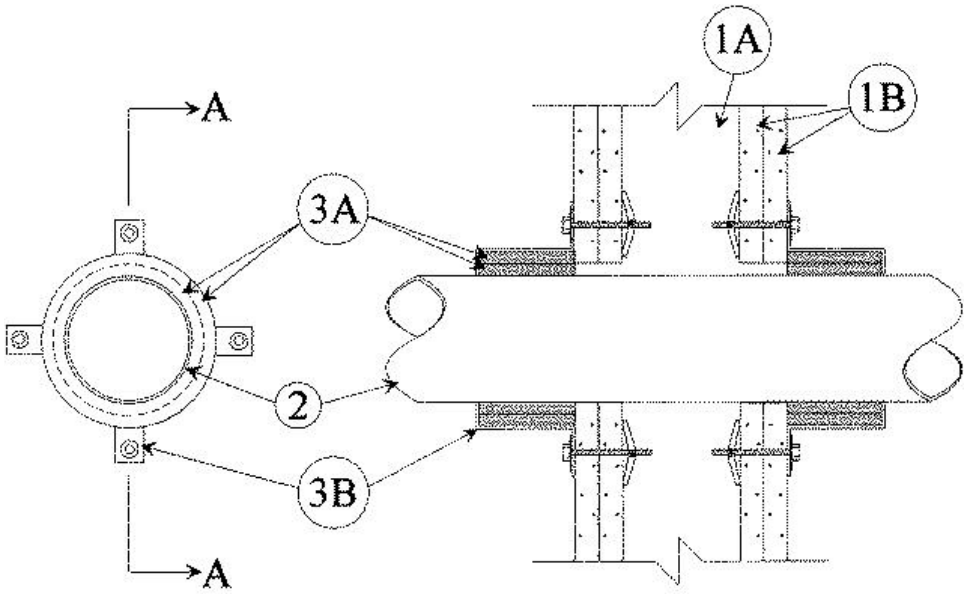
See General Information for Through-penetration Firestop Systems

System No. W-L-2101

December 10, 2008

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 1 and 1-1/2 Hr (See Item 1)



SECTION A-A

1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-5/8 in. wide and spaced max 24 in. OC.

B. **Gypsum Board* —** 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 5 in.
The hourly F and T Ratings of the firestop system are dependent on the hourly fire rating of the wall assembly in which it is installed as shown in the table below:

Rating of Wall Hr	F Rating Hr	T Rating Hr
2	2	1-1/2

1	1	1

2. **Through Penetrants —** One nonmetallic pipe or conduit to be either concentrically or eccentrically within the firestop system. The annular space between pipe or conduit and periphery of opening shall be min 0 in. (point contact) to max 1/2 in. Pipe or conduit to be rigidly supported on both sides of the wall assembly. The following types and sizes of nonmetallic pipes or conduit may be used:

A. **Polyvinyl Chloride (PVC) Pipe —** Nom 4 in. diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste, or vent) piping systems.

B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe —** Nom 4 in. diam (or smaller) SDR 17 CPVC pipe for use in closed (process or supply) or vented (drain, waste, or vent) piping systems.

C. **Rigid Nonmetallic Conduit+ —** Nom 4 in. diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code (NFPA 70).

3. **Firestop System —** The firestop system shall consist of the following:

A. **Fill, Void or Cavity Material* — Wrap Strip —** Nom 1/4 in. thick intumescent material faced on both sides with a plastic film, supplied in 1-1/2 in. wide strips. The layers of wrap strips are individually wrapped around the through penetrant with ends butted and held in place with masking tape. Butted ends in successive layers may be aligned or offset. The edge of the wrap strips shall abut each surface of the wall. The layers of wrap strips are installed on each side of the wall. The number of layers of wrap strip are dependent on the diam of the pipe or conduit as tabulated below:

Diam Of Through Penetrant, In.	Layers Of Wrap Strip
4	2
3	2
2	1

SPECIFIED TECHNOLOGIES INC — SpecSeal RED Wrap Strip, SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

C. **Steel Collar —** Collar fabricated from coils of precut 0.016 in. thick (No. 30 MSG) galv sheet steel available from wrap strip manufacturer. Collar shall be nom 1-1/2 in. deep with min four 1 in. wide by 2 in. long anchor tabs for securement to the wall. Retainer tabs, 3/4 in. wide tapering down to 1/4 in. wide and located opposite the anchor tabs, are folded 90 degree toward through penetrant surface to maintain the annular space around the through penetrant and to retain the wrap strips. Steel collar wrapped around wrap strips and through penetrant with a 1 in. wide overlap along its perimeter joint. Steel collar tightened around wrap strips and through penetrant using min 1/2 in. wide by 0.028 in. thick stainless steel hose clamp at midheight of steel collar. Collar secured to wall with 1/8 in. diam by min 2-3/4 in. long steel molly bolts in conjunction with min 1/4 in. by 1-1/4 in. diam steel fender washers. Steel collars are installed on each side of wall.

+Bearing the UL Listing Mark

*Bearing the UL Classification Marking

Last Updated on 2008-12-10

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- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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UL DESIGN W-L-3001

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

See General Information for Through-penetration Firestop Systems

System No. W-L-3001

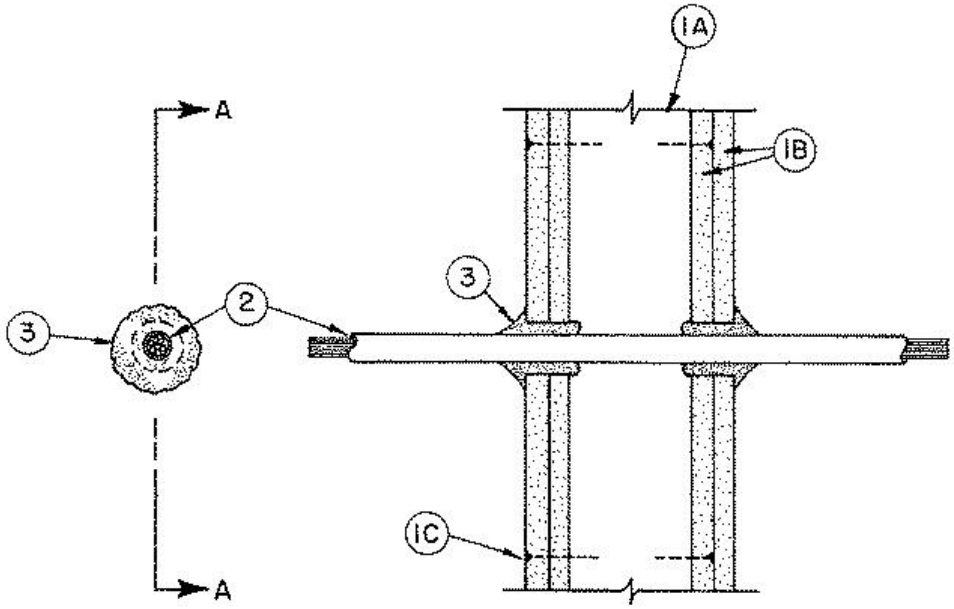
September 07, 2004

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 3/4, 1, 1-1/2 and 2 Hr (See Item 2)

L Rating At Ambient — 15 CFM/sq ft (See Item 3)

L Rating At 400 F — less than 1 CFM/sq ft (See Item 3)



SECTION A-A

1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC with nom 2 by 4 in. lumber end plates and cross braces. Steel studs to be min 3-5/8 in. wide by 1-3/8 in. deep channels spaced max 24 in OC.

B. **Gypsum Board* —** Nom 1/2 or 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers and sheet orientation shall be as specified in the individual Wall or Partition Design. Diam of circular through opening to be 3/8 in. to 5/8 in. larger than outside diam of cable or cable bundle.

C. **Fasteners —** When wood stud framing is employed gypsum wallboard layers attached to studs with cement coated nails as specified in the individual Wall or Partition Design. When steel channel stud framing is employed, gypsum wallboard attached to studs with Type S self-drilling, self-tapping bugle-head steel screws as specified in the individual Wall or Partition Design.
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Cables —** Individual cable or max 1 in. diam cable bundle installed in through opening with an annular space of min 0 in. (point contact) to max 3/4 in. Cable to be rigidly supported on both sides of wall assembly. The following types and sizes of cables may be used:

A. Max 150 pair No. 24 AWG copper conductor telephone cable with polyvinyl chloride (PVC) insulation and jacket materials. **When max 25 pair telephone cable is used, T Rating is 2 hr. When 50 to 150 pair telephone cable is used in 1 hr fire rated wall, T Rating is 3/4 hr. When 50 to 150 pair telephone cable is used in 2 hr fire rated wall, T Rating is 1 hr.**

B. Max No. 10 AWG multiple copper conductor Type NM ("Romex") nonmetallic sheathed cable with PVC insulation and jacket materials. **When Type NM cable is used, max T Rating is 1-1/2 hr.**

C. Multiple fiber optical communication cable jacketed with PVC and having a max outside diam of 5/8 in. **When fiber optic cable is used, max T Rating is 2 hr.**

D. Max 12 AWG multiconductor (max seven conductors) power/control cable with cross-linked polyethylene (XLPE) insulation and XLPE or PVC jacket materials. **When multiconductor power/control cable is used, max T Rating is 2 hr.**

E. Max four conductor with ground No. 2 AWG (or smaller) aluminum SER cables with polyvinyl chloride insulation amd jacket materials.

3. **Fill, Void or Cavity Materials* — Caulk, Sealant or Putty —** Caulk or putty fill material installed to completely fill annular space between cable and gypsum wallboard on both sides of wall and with a min 1/4 in. diam bead of caulk or putty applied to perimeter of cable(s) at its egress from each side of the wall. **3M COMPANY** — MP+ putty, CP 25WB+ caulk or FB-3000 WT sealant. (Note: L Ratings apply only when Type CP 25WB+ caulk or FB-3000 WT sealant is used.)

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Last Updated on 2004-09-07

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UL DESIGN W-L-3076

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

XHEZ7 - Through-penetration Firestop Systems Certified for Canada

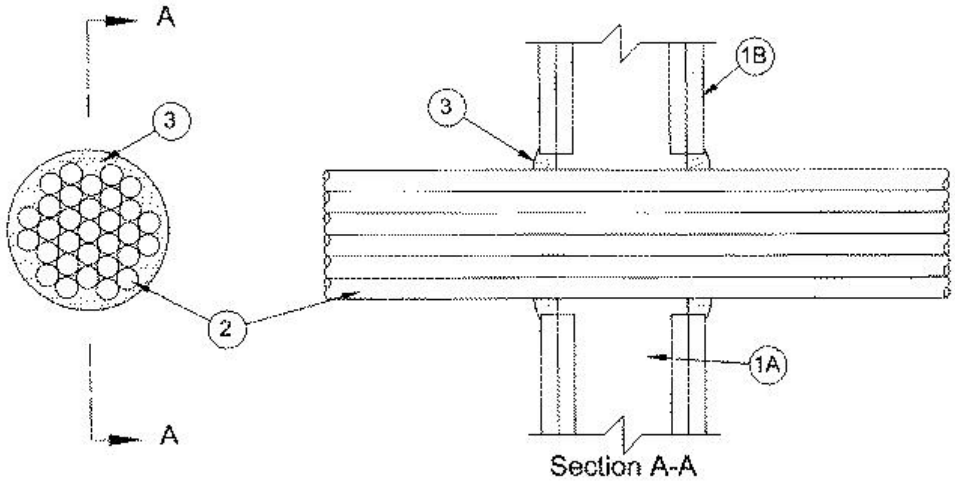
See General Information for Through-penetration Firestop Systems

See General Information for Through-penetration Firestop Systems Certified for Canada

System No. W-L-3076

August 23, 2011

ANSI/UL1479 (ASTM E814)	CAN/ULC S115	
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings —1 and 2 Hr (See Item 1)	
T Rating — 0 Hr	FT Rating — 0 Hr	
	FH Ratings — 1 and 2 Hr (See Item 1)	
	FTH Rating — 0 Hr	



1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.

B. **Gypsum Board * —** The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Series Design in the UL Fire Resistance Directory. Diam of circular cutout in gypsum board layers in each side of wall to be 1/2 in. (13 mm) larger than diam of tight cable bundle (Item 2 or 2A). Max diam of opening is 4-1/2 in. (114 mm).
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Cables —** Max 4 in. (102 mm) diam tight bundle of cables to be installed either concentrically or eccentricity in circular cutouts in gypsum board opening. Cables to be rigidly supported on both sides of wall assembly. The annular space within the firestop system shall be a min 0 in. (point contact) to a max 1/2 in. (13 mm). Any combination of the following types and sizes of cables may be used.

A. Max 150 pair No. 24 AWG (or smaller) copper conductor cable with polyvinyl chloride (PVC) insulation and jacket.

B. Max 1/C - 350 kcmil (or smaller) copper conductor cable with cross-linked polyethylene (XLPE) jacket.

C. Max 2/0 AWG (or smaller) copper conductor cable with a XLPE insulation and PVC jacket.

D. Max 3/C (with ground) No. 8 AWG nonmetallic sheathed (Romex) cable (or smaller) with copper conductor, polyvinyl chloride (PVC) insulation and jacket materials.

E. Max 3/C (with ground) No. 2/0 AWG (or smaller) aluminum or copper conductor service entrance cable with PVC insulation and jacket materials.

F. Max 4 pair No. 18 AWG (or smaller) copper conductor thermostat cable with PVC insulation and jacket materials.

G. Max RG/U Type 11 (or smaller) coaxial cable with fluorinated ethylene insulation and jacket materials.

H. Max 62.5/125 micron fiber optic cable with PVC insulation and jacket materials.

2A. **Through penetrating Product* —** As an alternate to the Item 2, a max 4 in. (102 mm) diam tight bundle of max 4 /C (with ground) - No. 2/0 AWG (or smaller) aluminum or steel jacketed **Armored Cable+** or **Metal-Clad Cable+** with aluminum or copper conductors may be used. The annular space between the cable bundle and the periphery of the opening shall be a min of 0 in. (point contact) to a max of 1 in. (25 mm). Through penetrating products may also be used in conjunction with the cables specified in Item 2. The through penetrating products are to be spaced min 1/2 in. (13 mm) from the cable bundle in Item 2. Cables to be rigidly supported on both sides of wall assembly.
AFC CABLE SYSTEMS INC

ENCORE WIRE CORP

3. **Fill, Void or Cavity Material* — Sealant —** Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. Fill material to be forced into interstices of cable group to max extent possible. At point contact location, apply min 1/4 in. (6 mm) diam bead of fill material at cable/gypsum board interface on both sides of wall.
SPECIFIED TECHNOLOGIES INC — SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

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Last Updated on 2011-08-23

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UL DESIGN W-L-5040

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

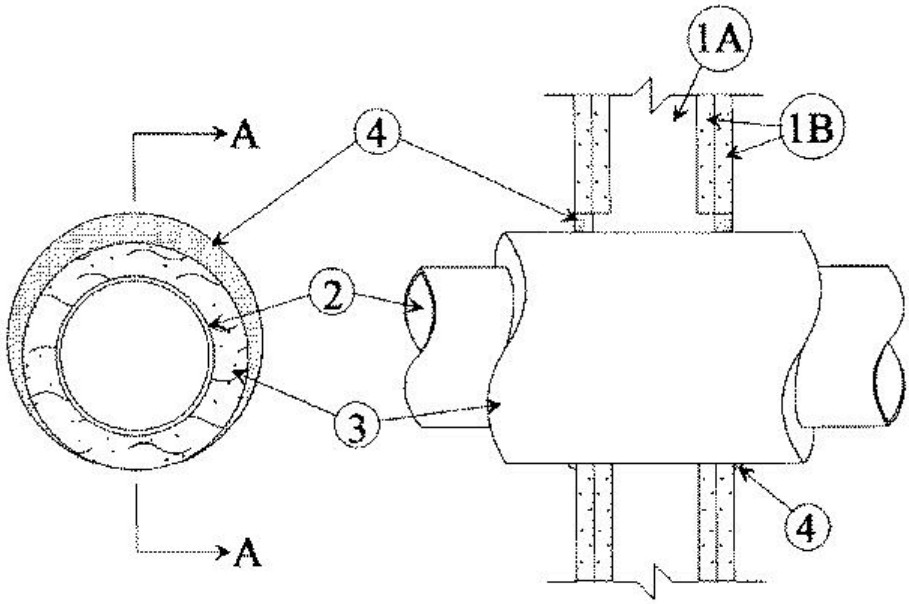
See General Information for Through-penetration Firestop Systems

System No. W-L-5040

September 07, 2004

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 1/4, 1/2 and 3/4 Hr (See Item 2)



SECTION A-A

1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-5/8 in. wide and spaced max 24 in. OC.

B. **Gypsum Board* —** Nom 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum wallboard type, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening in wallboard layers is 7 in.
The hourly F Rating of the firestop system is 1 hr when installed in a 1 hr fire rated wall and 2 hr when installed in a 2 hr fire rated wall.

2. **Through Penetrants —** One metallic pipe or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:

A. **Steel Pipe —** Nom 4 in. diam (or smaller) Schedule 10 (or heavier) steel pipe. **When steel pipe is used, T Rating is 3/4 hr.**

B. **Copper Tubing —** Nom 4 in. diam (or smaller) Type L (or heavier) copper tubing. **T Rating is 3/4 hr for copper tubing of nom 2 in. diam and smaller. For copper tubing greater than nom 2 in. diam, T Rating is 1/4 and 1/2 hr when installed in 1 and 2 hr rated walls, respectively.**

C. **Copper Pipe —** Nom 4 in. diam (or smaller) Regular (or heavier) copper pipe. **T Rating is 3/4 hr for copper pipe of nom 2 in. diam and smaller. For copper pipe greater than nom 2 in. diam, T Rating is 1/4 and 1/2 hr when installed in 1 and 2 hr rated wall respectively.**

3. **Pipe Insulation — Plastics# —** Nom 3/4 in. thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. The annular space between the insulated pipe and the edge of the through opening shall be min zero in. (point contact) to max 1-1/4 in.
See **Plastics#** (QMFZ2) category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL94 Flammability Classification of 94-5VA may be used.

4. **Fill, Void or Cavity Materials* — Caulk or Sealant —** Min 5/8 in. thickness of caulk applied within the annular space, flush with each surface of wall. A min 1/2 in. diam bead of caulk shall be applied to the pipe insulation/ wallboard interface at the point contact location on both sides of wall.
3M COMPANY — CP 25WB+ or FB-3000 WT

*Bearing the UL Classification Marking

#Bearing the UL Recognized Component Marking

Last Updated on 2004-09-07

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UL DESIGN W-L-7019

THROUGH-PENETRATION FIRESTOP SYSTEM

Assembly Usage Disclaimer

XHEZ - Through-penetration Firestop Systems

See General Information for Through-penetration Firestop Systems

System No. W-L-7019

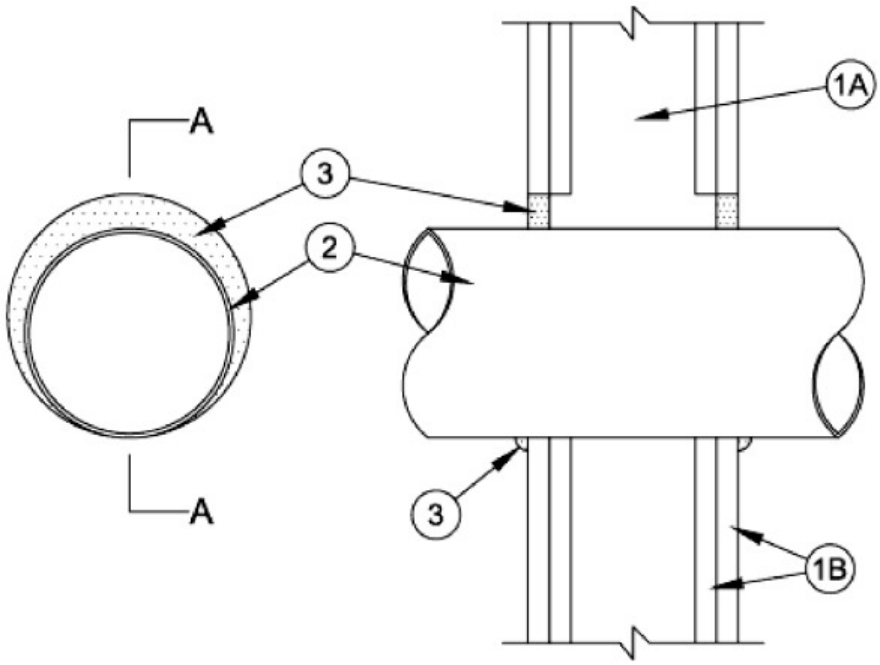
October 28, 2009

F Ratings — 1 & 2 Hr (See Item 1)

T Rating — 0 Hr

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



SECTION A-A

1. **Wall Assembly —** The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. **Studs —** Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC with nom 2 by 4 in. (51 by 102 mm) lumber end plates and cross braces. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.

B. **Gypsum Board* —** The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400

Series Design in the UL Fire Resistance Directory. Max diam of opening is 11 in.(279 mm).
The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Through Penetrant —** One nom 10 in. (254 mm) diam (or smaller) No. 28 MSG (or heavier) steel vent pipe to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe and periphery of opening shall be min 0 in. (point contact) to max 1 in. (25 mm). Pipe to be rigidly supported on both sides of wall assembly.

3. **Fill, Void or Cavity Material* — Sealant —** Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrant and gypsum board, a min 3/8 in. (10 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.
SPECIFIED TECHNOLOGIES INC — SpecSeal Series SSS Sealant, SpecSeal LCI Sealant or Type WF300 Firestop Caulk (wood stud walls only).

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Last Updated on 2009-10-28

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