

Specifications for

Evren Apartments

Tudor Road & Douglas Street
Lee's Summit, Missouri

for
Cityscape Tudor Road Apartments, LLC

Architect and Landscape Architect

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Prairie Village, Kansas

MEP Engineer

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Overland Park, Kansas

Interior Designer

Mitsch Design
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September 16, 2024
Permit Set

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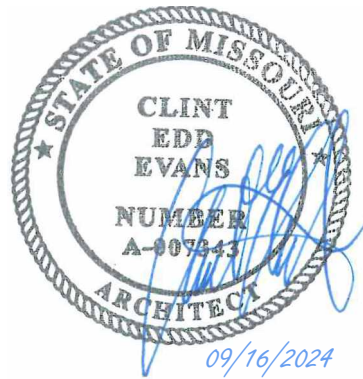
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ARCHITECT OF RECORD

*NSPJ Architects, P.A.
9415 Nall Ave., Suite 300
Prairie Village, Kansas 66208*

Clint Evans
Architect of Record

9 / 16 / 2024
Date

END OF SECTION 000105.1

BOB D CAMPBELL & CO, INC.

I hereby certify that documents intend to be authenticated by my seal are limited to the following:

SPECIFICATIONS:

Sections 033000, 042200, 051200, 061000, 061600, 061753, 316613

DRAWINGS:

S-Series drawings bearing my seal.

STRUCTURAL ENGINEER OF RECORD

*Bob D. Campbell & Company, Inc.
4338 Belleview Avenue
Kansas City, Missouri*



Structural Engineer of Record

09/16/2024
Date

END OF SECTION 000105.3






5-23-24

**MECHANICAL, ELECTRICAL & PLUMBING
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MPE Engineer of Record

05/23/2024
Date

END OF SECTION 000105.4



LANDSCAPE ARCHITECT OF RECORD

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Prairie Village, Kansas 66208*

Katie Martinovic
Landscape Architect of Record

9 / 16 / 2024
Date

END OF SECTION 000105.4

GENERAL**1.1 CONTRACT DOCUMENTS SHALL CONSIST OF THE FOLLOWING:**

- A. General Conditions.
- B. Supplementary General Conditions.
- C. Construction Documents.
 - 1. Specifications - Division 01 through Division 33.
 - 2. Construction Drawings: Reference Drawing Sheet A0.00 (Cover Sheet) for an Index of Drawings.

END OF SECTION 010005

SECTION 010010**GENERAL CONDITIONS**

- 010010-1 The General Conditions of the Contract for the Construction of Buildings, American Institute of Architects, Standard Form No. A-201, latest edition, is hereby made part of this Specification and shall govern all divisions and sections of this Specification.
- 010010-2 Copies of the General Conditions, Standard Form No. A-201, are on file and may be examined in the office of the Architect, 9415 Nall Ave., Suite 300, Prairie Village, Kansas 66207.

END OF SECTION 010010

SECTION 010020

SUPPLEMENTARY GENERAL CONDITIONS

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010020-1	General Conditions
010020-2	Builders Risk Insurance
010020-3	Power of Attorney
010020-4	Time Extensions for Adverse Weather
010020-5	Time Extensions for other than Weather

10020-1 GENERAL CONDITIONS

The "General Conditions of the Contract for Construction", AIA Document A-201 are general in scope and may refer to conditions not encountered on the work covered by this Contract. Any provision of the said document which pertains to a nonexistent condition and not applicable to the work to be performed hereunder, or which conflicts with any provision of the Supplementary General Conditions, shall have no meaning in the contract and shall be disregarded.

The Contractor and each Subcontractor affirmatively represents that they are skilled and experienced in the performance of work as required by this project and in the use and interpretation of Drawings and Specifications such as those included in the Contract Documents; that they have carefully reviewed the Drawings and Specifications of this project; and that their Contract is based solely on these Documents, not relying in any way on any explanation or interpretations - oral or written - from any other source. The Contractor agrees that it shall be conclusively presumed that the Contractor has exercised his aforementioned skill and experience and found the Drawings and Specifications sufficient and free from ambiguities, errors, or omissions for the purpose of determining its Contract for the performance of the work in conformity with the Drawings, Specifications, and all other Contract Documents.

010020-2 BUILDER'S RISK INSURANCE

The Contractor shall furnish Builder's Risk Insurance and assume the deductible.

010020-3 POWER OF ATTORNEY

Attorneys-in-fact who sign contract bonds must file with each one a certified and effectively dated copy of their power of attorney.

010020-4 TIME EXTENSION FOR ADVERSE WEATHER

- A. The Contractor shall comply with all provisions of the General Conditions in submitting any request for extension of Contract Time due to unusually severe weather.
- B. Definitions:
 1. Adverse Weather – atmospheric conditions at a definite time and place which are unfavorable to construction activities.
 2. Unusually Severe Weather - weather which is more severe than the adverse weather anticipated for the season, location, or activity involved.
- C. In order for any request of time extension due to unusually severe weather to be valid, the Contractor must document both of the following conditions.
 1. The weather experienced at the project site during the Contract period is more severe than the adverse weather anticipated for the project location during any given month.
 2. The unusually severe weather actually caused a delay to the scheduled progress and/or completion of the project. The delay must be beyond the control and without fault or negligence by the Contractor.
- D. The following schedule of monthly anticipated adverse weather delays will constitute the baseline for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather-affected activities:

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS

BASED ON FIVE (5) DAY (Monday – Friday) WORK WEEK

<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>
10	8	7	6	7	7	5	5	5	4	5	9

- E. Upon receipt of the Notice to Proceed, and continuing throughout the contract, the Contractor shall record on their daily construction report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50% or more of contractor's scheduled workday.
- F. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in the previous month), and shall be calculated chronologically from the first to the last day of each month, and be recorded as full workdays.

1. If the number of actual adverse weather delay days in a given month exceeds the number of days anticipated in Paragraph D, above, the difference shall be multiplied by 7/5 to convert any qualifying workday delays to calendar days. The resulting number of qualifying lost days shall be added upon approval by the Architect and Owner to the contract time.
 2. The determination that unusually severe weather occurred does not automatically mean an extension of time will be granted. The contractor must substantiate the unusually severe weather delayed work activities on the critical path of the Progress Schedule.
- G. Full consideration for equivalent fair weather workdays shall be given. If the number of actual adverse weather delays in a given month is less than the number of days anticipated in Paragraph D, above, the difference shall be multiplied by 7/5 to convert any work day increases to calendar days. The resulting number of qualifying extra days will be accumulated and subtracted from any future month's days lost due to unusually severe weather.
1. The net cumulative total of extra days/lost days shall not result in a reduction of Contract Time and the Date of Substantial Completion shall not be changed as a result of unusually favorable weather.
- H. In converting workdays to calendar days fractions less than 0.5 shall be rounded up to the next whole number. Fractions less than 0/5 shall be dropped.
- I. The contractor shall summarize and report all actual adverse weather delay days for the preceding month to the architect by the tenth (10th) day of the following month. A narrative indicating the impact of adverse weather conditions on the scheduled critical activities shall be included.
1. Any request or claim for an extension of time due to unusually severe weather shall be submitted to the architect and owner within twenty-one (21) days of the last day of the month in which the delay occurred. Resolution of any weather delay claim shall follow the procedures established by the general conditions and as prescribed above.
- J. The contractor shall include and indicate the monthly anticipated adverse weather days listed in Paragraph D, above, in their progress schedule.
1. The contractor shall indicate the actual adverse weather days (whether less or more than the anticipated days) in their monthly progress schedule update.

010020-5 TIME EXTENSION FOR FACTORS OTHER THAN WEATHER

- A. If the contractor incurs a delay due to factors out of his control, the contractor shall submit a claim within twenty-one (21) days after the occurrence of the delay to the

architect and project team. The claim shall include a description of the cause of the delay and resultant request for additional time.

- B. If a proposal request for additional work causes the contractor additional time to perform the original contract requirements the contractor may submit a claim for additional time to the Architect and Owner. The Contractor shall include in his proposal the request for time extension (if any), and shall include sufficient information and dates to demonstrate whether and to what extent the change will delay the completion of the contract in its entirety.
- C. The determination that delays have occurred beyond the Contractor's control does not automatically mean an extension of time will be granted. The Contractor must substantiate the delay by indicating suspended work activities on the critical portion of the project schedule.

END OF SECTION 010020

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Contractor's use of site and premises.
 - 2. Work restrictions.
 - 3. Specification and Drawing conventions.

1.2 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.3 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

1.4 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. 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.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 2. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 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.
 - 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 to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form provided in Project Manual.
 - 2. 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.
 - 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.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 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 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: Architect will consider requests for substitution if received within 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



SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____
_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND RECOMMENDATION

- ☐ Approve Substitution - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Approve Substitution as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Reject Substitution - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

OWNER'S REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- ☐ Substitution rejected - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, or other form acceptable to the Owner and Contractor.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or a form acceptable to the owner and Contractor.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 or other form acceptable to the owner and contractor. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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

1.2 DEFINITIONS

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

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.

- c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
3. 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 percent of the Contract Sum.
 4. 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.
 5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
 6. Temporary Facilities: 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 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.

1.4 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 Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. 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.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- 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. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. 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. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 6. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 7. AIA Document G707, "Consent of Surety to Final Payment."
 8. Evidence that claims have been settled.
 9. 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.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

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 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. Requests for Information (RFIs).
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

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

1.3 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.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, on Project Web site, and in prominent location in built facility. Keep list current at all times.

1.4 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. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

1.5 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. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

- c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. 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. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
- 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
- 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. 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. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Preparation Format:
 - a. 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.

1.6 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 to avoid delays in Contractor's work or work of subcontractors.
 3. Contractor shall endeavor to respond to subcontractor RFI's first, prior to sending to Architect for a response.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Owner name.
 3. Name of Architect.
 4. Architect's Project number.
 5. Date.
 6. Name of Contractor.
 7. RFI number, numbered sequentially.
 8. RFI subject.
 9. Specification Section number and title and related paragraphs, as appropriate.
 10. Drawing number and detail references, as appropriate.
 11. Field dimensions and conditions, as appropriate.
 12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 13. Contractor's signature.
 14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in PDF format.
 - D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven 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 according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 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 at every Owner, Architect, Contractor (OAC) Meeting. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number, including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 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 three days if Contractor disagrees with response.
- 1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software 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 up to seven Project management software user licenses for use of Owner, Architect, and Architect's consultants. Provide up to eight hours of software training at Architect's office for web-based Project software users if needed.
 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.
- B. 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.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 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. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute 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. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

- a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at a minimum of biweekly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: 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) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.

- 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) 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 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
- B. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
 - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF file.
- B. Startup Construction Schedule.
 - 1. Approval of cost loaded start-up schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.

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

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1.7 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

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

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule:** Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals

- required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Category and type of submittal.
 8. Submittal purpose and description.
 9. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 10. Drawing number and detail references, as appropriate.
 11. Indication of full or partial submittal.
 12. Location(s) where product is to be installed, as appropriate.
 13. Other necessary identification.
 14. Remarks.
 15. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

- E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 - 2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is necessary, allow 21 days for initial review of each submittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. 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.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. 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: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.

- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. 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.
 6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full sets 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. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

- 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. 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, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.

- c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 - 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. 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.
- J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.4 DELEGATED DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified is 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.

1.6 ACTION SUBMITTALS

- A. **Mockup Shop Drawings:**
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Qualification Data:** For Contractor's quality-control personnel.
- C. **Contractor's Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. **Testing Agency Qualifications:** 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.
- E. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 1. Date of issue.
 2. Project title and number.
 3. Name, address, telephone number, and email address 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 inspection.
 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.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, telephone number, and email address of technical 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 of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. 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.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.
- 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 is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

3. Provide sizes and configurations of test assemblies, and mockups, to adequately demonstrate capability of products to comply with performance requirements.
 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. 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 of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 10. Demolish and remove mockups when directed unless otherwise indicated.

1.10 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 inspection 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. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. 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.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. 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.
- D. 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 locations 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 duties of Contractor.
- E. 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 Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.11 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. 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.
 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 5. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
29. ARI - American Refrigeration Institute; (See AHRI).
30. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
31. ASA - Acoustical Society of America; www.acousticalsociety.org.
32. ASCE - American Society of Civil Engineers; www.asce.org.
33. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
34. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
35. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
36. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.

37. ASSP - American Society of Safety Professionals (The); www.assp.org.
38. ASTM - ASTM International; www.astm.org.
39. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
40. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
41. AWI - Architectural Woodwork Institute; www.awinet.org.
42. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
43. AWWPA - American Wood Protection Association; www.awpa.com.
44. AWS - American Welding Society; www.aws.org.
45. AWWA - American Water Works Association; www.awwa.org.
46. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
47. BIA - Brick Industry Association (The); www.gobrick.com.
48. BICSI - BICSI, Inc.; www.bicsi.org.
49. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
50. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
51. CARB - California Air Resources Board; www.arb.ca.gov.
52. CDA - Copper Development Association; www.copper.org.
53. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking>.
54. CEA - Canadian Electricity Association; www.electricity.ca.
55. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
56. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
57. CGA - Compressed Gas Association; www.cganet.com.
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CPA - Composite Panel Association; www.compositepanel.org.
63. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
64. CRRC - Cool Roof Rating Council; www.coolroofs.org.
65. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
66. CSA - CSA Group; www.csa-group.org.
67. CSI - Cast Stone Institute; www.caststone.org.
68. CSI - Construction Specifications Institute (The); www.csiresources.org.
69. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
70. CTA - Consumer Technology Association; www.cta.tech.
71. CTI - Cooling Technology Institute; www.coolingtechnology.org.
72. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
73. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
74. DHI - Door and Hardware Institute; www.dhi.org.
75. ECA - Electronic Components Association; (See ECIA).
76. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
77. ECIA - Electronic Components Industry Association; www.ecianow.org.
78. EIA - Electronic Industries Alliance; (See TIA).
79. EIMA - EIFS Industry Members Association; www.eima.com.
80. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
81. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
82. ESTA - Entertainment Services and Technology Association; (See PLASA).
83. EVO - Efficiency Valuation Organization; www.evo-world.org.
84. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
85. FGIA - Fenestration and Glazing Industry Alliance; <https://fgiaonline.org>.

86. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
87. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
88. FM Approvals - FM Approvals LLC; www.fmglobal.com.
89. FM Global - FM Global; www.fmglobal.com.
90. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridarooft.com.
91. FSA - Fluid Sealing Association; www.fluidsealing.com.
92. FSC - Forest Stewardship Council U.S.; www.fscus.org.
93. GA - Gypsum Association; www.gypsum.org.
94. GANA - Glass Association of North America; (See NGA).
95. GS - Green Seal; www.greenseal.org.
96. HI - Hydraulic Institute; www.pumps.org.
97. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
98. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Association; www.theicpa.com.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
111. II - Infocomm International; (See AVIXA).
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; www.intertek.com.
114. ISA - International Society of Automation (The); www.isa.org.
115. ISFA - International Surface Fabricators Association; www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ITU - International Telecommunication Union; www.itu.int.
118. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
119. LMA - Laminating Materials Association; (See CPA).
120. LPI - Lightning Protection Institute; www.lightning.org.
121. MBMA - Metal Building Manufacturers Association; www.mbma.com.
122. MCA - Metal Construction Association; www.metalconstruction.org.
123. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
124. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
125. MHI - Material Handling Industry of America; www.mhia.org.
126. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.

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178. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
179. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
180. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
181. SPIB - Southern Pine Inspection Bureau; www.spib.org.
182. SPRI - Single Ply Roofing Industry; www.spri.org.
183. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
184. SSINA - Specialty Steel Industry of North America; www.ssina.com.
185. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
186. STI - Steel Tank Institute; www.steeltank.com.
187. SWI - Steel Window Institute; www.steelwindows.com.
188. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
189. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
190. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
191. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
192. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
193. TMS - The Masonry Society; www.masonrysociety.org.
194. TPI - Truss Plate Institute; www.tpinst.org.
195. TPI - Turfgrass Producers International; www.turfgrasssod.org.
196. TRI - Tile Roofing Institute; www.tilerroofing.org.
197. ULSE - UL Standards & Engagement Inc.; www.ulse.org.
198. UL - Underwriters Laboratories Inc.; www.ul.com.
199. USAV - USA Volleyball; www.usavolleyball.org.
200. USGBC - U.S. Green Building Council; www.usgbc.org.
201. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
202. WA - Wallcoverings Association; www.wallcoverings.org.
203. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
204. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
205. WDMA - Window & Door Manufacturers Association; www.wdma.com.
206. WI - Woodwork Institute; www.wicnet.org.
207. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
208. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.

5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.

2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these

- operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste-handling procedures.
 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
1. Methods used to meet the goals and requirements of the Owner.
 2. Concrete cutting method(s) to be used.
 3. Location of construction devices on the site.
 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
 6. Indicate locations of sensitive areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.
- D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- E. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Field Offices: Owner will provide conditioned interior space for field offices for duration of Project.
- C. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 1. Install electric power service overhead unless otherwise indicated.
 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment land-based telephone line(s) for each field office.
 1. Provide additional telephone lines for the following:
 - a. Provide one telephone line(s) for Owner's use.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Construction Manager's home office.
 - g. Engineers' offices.
 - h. Owner's office.
 - i. Principal subcontractors' field and home offices.
- K. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 2. Utilize designated area within existing building for temporary field offices.
 3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas.

3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary offsite parking areas for construction personnel, unless space available within construction limits.
- F. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide one 8'-0" x 8'-0" painted plywood sign incorporating the development rendering and such other information as will be provided by the development team.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Elevator Use: Use of Owner's elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
1. Do not load elevators beyond their rated weight capacity.
 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

- L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 2. Paint and maintain appearance of walkway for duration of the Work.
- L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Insulate partitions to control noise transmission to occupied areas.
 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 6. Protect air-handling equipment.
 7. Provide walk-off mats at each entrance through temporary partition.

- N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

- a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
- b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
- c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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. The Specifications (Project Manual) shall govern over any conflicts or discrepancies between material specifications, colors, or drawings generally and shall be assumed part of the bid unless clarified by the contractor thru written means as described below. Where there is a conflict or discrepancy between material specifications, colors, or drawings, it shall be assumed the more stringent and or more expensive product and labor intensive to install will be included.
- C. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 014200 "References" for applicable industry standards for products specified.
 - 3. Section 01770 "Closeout Procedures" for submitting warranties.

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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: 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.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 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.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

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 that products are undamaged and properly protected.
- C. Storage:
 - 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.
 - 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 - 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.

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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 in the Project Manual, prepare a written document, using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. 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 be considered.

- a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
- 4. 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."
- 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally 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 Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a 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 the following 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.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. 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.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
 - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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.
 - 8. Correction of the Work.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting surveys.
 - 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.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit two copies signed by professional engineer.
- C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.

3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 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. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. 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, or when encountering the need for cutting and patching of elements whose structural function is not known, 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. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 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. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.

- c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
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.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

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, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with 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 and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following 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. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. 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.
- D. Final Property Survey: Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. 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. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb, and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- 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: 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 with manufacturer.
 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, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. 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. 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 minimize interruption to occupied areas.
- F. 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.
- G. 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, as judged by Architect. 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 eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

- b. Restore damaged pipe covering to its original condition.
- 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. 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. 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 (27 deg C).
 - 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.
- 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: 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.
- 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.
- K. Upon preliminary acceptance, the General Contractor will be relieved of further responsibility for cleaning with the exception of such specific items as are listed in the report of deficiencies at the time of inspection and acceptance.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. 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.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final Completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. 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.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
 1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS

- A. Organization 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. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial

Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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: Perform 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 designated portion of Project:
 - a. Clean Project site 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
- i. Vacuum and mop concrete.
- j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- l. Remove labels that are not permanent.
- m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
- q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- r. Clean strainers.
- s. Leave Project clean and ready for occupancy.

- C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Systems and equipment operation manuals.
 - 3. Systems and equipment maintenance manuals.
 - 4. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and its consultants will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. 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 and contact information for Contractor.
 6. Name and contact information for Architect.
 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 8. 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 binder.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each operation, and maintenance manual.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 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.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. 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 warranties and bonds as described below.

C. 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 and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. 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.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. 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 maintenance manuals.
- 1.9 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. 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.
- C. 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 and drawing or schedule designation or identifier where applicable.
- D. 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.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of the Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:

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

1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. 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.
- C. Format: Submit Record Product Data as annotated PDF electronic file.
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 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.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 035413 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Self-leveling, gypsum cement underlayment for application below interior floor coverings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum cement underlayment.
2. Reinforcement.
3. Primer.
4. Corrosion-resistant coating.
5. Surface sealer.
6. Sound control mat.

- B. Shop Drawings:** Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.

B. Test Reports:

1. For fire-resistant ratings, from a qualified testing agency.
2. For STC-rated assemblies, from a qualified testing agency.
3. For IIC-rated assemblies, from a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:** Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility:** Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
- C. All materials, unless otherwise indicated, all products shall be installed in accordance with its current printed directions and recommendations of the manufacturer.**

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified 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.
 - 1. STC Rating: 57-59.
- C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E492 and classified according to ASTM E989 by an independent testing agency.
 - 1. IIC Rating: 50-53.

2.2 GYPSUM CEMENT UNDERLAYMENTS

- A. Gypsum Cement Underlayment: Self-leveling, gypsum cement product that can be applied in minimum uniform thickness of 3/4-inch to match adjacent floor elevations.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arcosa Inc.; Accucrete.
 - b. Hacker Industries, Inc.; Firm-Fill 2010+ Gypsum Concrete.
 - c. Maxxon Corporation; Gyp-Crete 2000 Multifamily.
 - d. USG Corporation; USG Levelrock® Brand 2500 Underlayment.
 - 2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C219.
 - 3. Compressive Strength: Not less than 3000 psi at 28 days when tested according to ASTM C472.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.
- G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

2.3 ACCESSORIES

- A. Sound Control Mat: As required to meet STC and IIC ratings, manufactured by gypsum cement underlayment manufacturer.
 1. Thickness: 1/8 inch.
- B. Sound reduction mat shall be one of the following manufacturers and provide an IIC rating of 50-53 and an STC of 57-59 with a 3/4-inch Gyp-Crete topping with an overall thickness of one inch, under areas to receive hard surface flooring.
 1. Acousti-Mat 1/8 Sound Mat by Maxxon Corporation.
 2. Firm Fill SCM-125 by Hacker Industries, Inc.
 3. SAM-N12 by USG.
 4. AccuQuiet D18 by Arcosa Inc.
- C. Acoustical Isolation strips shall be by Acousti-Mat, as manufactured by Maxxon, Hacker Industries, Inc., or USG.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrate according to manufacturer's written instructions.
 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.

- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by gypsum cement underlayment manufacturer.
- C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
 - 1. Install underlayment reinforcement recommended in writing by manufacturer.
- D. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.
- E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond; prepare surfaces according to manufacturer's written instructions.
- F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
- G. Sound Control Mat: Install sound control materials according to manufacturer's written instructions.
 - 1. Do not install mechanical fasteners that penetrate through the sound control materials.

3.3 INSTALLATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
 - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Install Acousti-Mat 1/8 Sound mat over prepared wood subfloor with taped joints. Install Acoustical Isolation strips around the perimeters of all rooms at floor edges.
- C. Mix Design shall be per manufacturer's written installation recommendations. The underlayment shall attain a typical compressive strength of 3,000 psi to 3,200 psi and in compliance with all flooring material manufacturers requirements for subfloor strengths as scheduled for this project. Place gypsum cement underlayment 3/4-inch thick over sound

control mat over all areas to receive hard surface flooring on the second, third and fourth floor multi-family areas.

- D. Subfloor shall be minimum 23/32-inch OSB with American Plywood Association trademark and fastened according to APA recommendations. Subfloor to be in sound condition, broom clean and free from contaminates.
- E. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- F. Install underlayment to produce uniform, level surface.
 - 1. Install a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- G. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- H. Preparation for Installation of Glue-Down Floor Goods: Seal all areas that receive glue down floor goods with Maxxon Overspray or Maxxon Acrylic according to the Maxxon Corporation's specifications. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used. Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.
- I. See Maxxon Corporation's, Hacker Industries or USG's "Procedures for Attaching Finished Floor Goods to Maxxon, Hacker or USG Underlayments" brochure for guidelines for installing finished floor goods. This procedure is not a warranty and is to be used as a guideline only.
- J. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- K. Apply surface sealer at rate recommended by manufacturer.
- L. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 INSTALLATION TOLERANCES

- A. Finish and measure surface, so gap at any point between gypsum cement underlayment surface and an unleveled, freestanding, 10-foot-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

3.5 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035413

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Miscellaneous masonry accessories.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.

4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 5. Grout mixes. Include description of type and proportions of ingredients.
 6. Reinforcing bars.
 7. Joint reinforcement.
 8. Anchors, ties, and metal accessories.
- 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 C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for each type of exposed unit masonry construction in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in each mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 2. Protect accepted mockups from the elements with weather-resistant membrane.
 3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- 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.
- D. 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 TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Density Classification: Normal weight unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
- C. Concrete Building Brick: ASTM C55.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 7-5/8 inches long.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in density classification, 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 C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- E. Aggregate for Grout: ASTM C404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The); an RPM company; Accelguard 80.
 - b. GCP Applied Technologies Inc.; Morset.
 - c. Master Builders Solutions; Master Set FP 20.
- G. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.
 - c. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
 1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: 0.148-inch diameter.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Spacing of Cross Rods: Not more than 16 inches o.c.
 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.6 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. 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 A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- C. 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-diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire.
- D. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches 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.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, 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 felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.8 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 mortar unless otherwise indicated.
 - 3. 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 C270, 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 exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C476, Table 1.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. 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.

3.3 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 or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch 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, or 1/2-inch 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, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch 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, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 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 horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs 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.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
- 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 TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

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 as follows:
 - 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 interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Provide 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.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY

- 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 TMS 602/ACI 530.1/ASCE 6.
- 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 TMS 602/ACI 530.1/ASCE 6 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.

3.11 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: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 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. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. 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. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 044313.16 - ADHERED MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry adhered to concrete backup.
2. Masonry adhered to wood framing and sheathing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of brick, accessory, and manufactured product.

B. Samples:

1. For each brick types indicated. Include at least three Samples in each set, and show the full range of color and other visual characteristics in completed Work.
2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.

B. Material Test Reports:

1. Test Reports: For each brick type proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer, indicating that sealants will not stain or damage brick. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:** A qualified installer who employs experienced masons.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Compatibility and Adhesion Testing:** Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.8 FIELD CONDITIONS

- A. Protection of brick: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides, and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter, using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- C. 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 masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.9 COORDINATION

- A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Brick: Obtain each variety of brick, regardless of finish, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 THIN BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including corners, movement joints, bond beams, sashes, and lintels.
- B. Clay Thin Brick: Thin brick complying with ASTM C216, Grade SW, Type TBS.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acme Brick Company.
 - b. Belden Brick Company (The).
 - c. Endicott Clay Products Co.
 - d. General Shale Brick, Inc.
 - e. Glen-Gery Corporation.

B. BRICK MATERIAL STANDARDS

- 1. Comply with ASTM AC51 Water Absorption.
- 2. Comply with ASTM C358 for Flexural Strength.
- 3. Comply with ASTM C482 for Bond Strength of Ceramic Tile to Portland Cement, strength of bond not less than 50 psi.
- 4. Per ASTM C39 and C192 – Compressive Strengths shall be greater than or equal to 1,800 psi average of 5 specimens and none shall be less than or equal to 1,500 psi.
- 6. Flame Spread 25.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Solomon Colors Inc.
 - c. Spec Mix.
- E. Aggregate: ASTM C144 and as follows:
 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
 2. White Aggregates: Natural white sand or ground white stone.
 3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- F. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bostik, Inc.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. Parex USA, Inc.
- G. Water: Potable.

2.4 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 1. Stainless Steel: ASTM A240/A240M, Type 304, 0.016 inch thick.
 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 3. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 4. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

- B. Flexible Flashing: For flashing unexposed to the exterior, use the following unless otherwise indicated:
1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Firestone Building Products.
 - 3) GCP Applied Technologies, Inc.
 - 4) Heckmann Building Products, Inc.
 - 5) Hohmann & Barnard, Inc.
- C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing or flexible flashing with a metal drip edge.
 4. Where flashing is fully concealed, use metal flashing or flexible flashing.
- D. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
 2. Elastomeric Sealant: ASTM C920, chemically curing polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Weather Barrier compliant with or better than ASTM E2556, Type II shall be installed over the wall sheathing per Section 072500 by others prior to the start of this masonry work.
- B. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- C. Weep Products: Use the following unless otherwise indicated:
1. Mesh Weep Vent: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of masonry; in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Mortar Net Weep Vents by Mortar Net Solutions.
 - 2) Driwall Weep Vents by Keene Building Products.

- D. Expanded Metal Lath: 3.4 lb./sq. yd., self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G60.
 - 1. Water-Resistive Barrier: Vapor-permeable paper, factory bonded to back of lath; complying with requirements in FS UU-B-790a for Type I, Grade D.
- E. Drainage Mat: MTI 10mm Sure Cavity as manufactured by Masonry Technologies, Inc, Cresco, Iowa.
- F. Fasteners: Shall be Type S-12 galvanized or SS with 1-1/4-inch minimum penetration into wood studs behind sheathing. Material and type required by ASTM C1063 for installations indicated.

2.6 MASONRY CLEANERS

- A. Manufacturer's recommended means and methods for soap and water cleaners for removing mortar and grout stains, efflorescence, and other new construction stains from masonry surfaces ASAP, without discoloring or damaging masonry surfaces; expressly approved for intended use by the brick producer.

2.7 FABRICATION

- A. General: Fabricate brick units in sizes and shapes required to comply with requirements indicated.
- B. Select brick to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Masonry" Article.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Carefully inspect brick at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of brick to remove rust stains and iron particles.
- E. Thickness of Brick: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 1 inch plus or minus 1/4 inch.
 - 2. Comply with Building Code maximum weight/sf requirements.
- F. Finish exposed brick faces and edges to comply with requirements indicated for finish.
 - 1. Finish: As selected by pattern name and joint selection, TBD. For all pieces, including sills, lintels, special shapes, outside corners, etc.
 - a. Finish exposed ends of copings same as front and back faces.

2.8 MORTAR 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.
 2. Use portland cement-lime mortar unless otherwise indicated.
 3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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 Masonry: Comply with ASTM C270, Proportion Specification.
1. Mortar for Setting Brick: Type S.
 2. Mortar for Pointing Brick: Type S.
- D. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
1. For latex-modified portland cement, setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
- E. Mortar for Scratch Coat over Metal Lath: 1-part portland cement, 1/2-part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
- F. Pigmented Mortar: Use colored cement product.
1. Pigments shall not exceed 10 percent of portland cement by weight.
- G. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean dirty or stained surfaces by removing soil, stains, and foreign materials before setting. Clean brick by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING MASONRY

- A. Brick patterns and bond patterns shall be as indicated on drawings and as selected by Owner, with special corners and trim pieces as required.

- B. Set brick to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure masonry in place. Set brick accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
- C. Maintain uniform joint widths, except where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 5/8 inch at widest points.
- D. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealing joints are specified in Section 079200 "Joint Sealants."
- E. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between masonry and backup wythe. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
- F. Respect expansion and control joint locations for back up materials and carry thru these masonry materials to allow for wall shrinkage in height, and thermal fluctuations.
- G. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At stud-framed walls extend flashing through masonry, up sheathing face at least 12 inches, and behind weather barrier.
 - 2. At concrete backing, extend flashing through masonry, turned up a minimum of 12 inches, and insert in reglet.
 - 3. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 - 4. At sills, extend flashing not less than 4 inches at ends.
 - 5. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
 - 6. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
 - 7. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face, and adhere flexible flashing to top of metal drip edge.
 - 8. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face, and adhere flexible flashing to top of metal flashing termination.
 - 9. Cut flexible flashing flush with wall face after completing masonry wall construction.
- H. Place weep holes in joints where moisture may accumulate, including above shelf angles and at flashing.
 - 1. Use perforated hot dip galvanized or stainless-steel starter track to form weep holes to drain walls.
 - 2. Space weep holes 16 inches o.c.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- E. Variation in Plane between Adjacent Brick: Do not exceed one-half of tolerance specified for thickness of brick.

3.5 INSTALLATION OF ADHERED MASONRY VENEER

- A. Install flashing over sheathing and behind building paper or wrap and drainage material by fastening through sheathing into framing.
- B. Install galvanized metal lath over building paper or wrap and drainage material by fastening through sheathing into framing to comply with ASTM C1063.
- C. Install scratch coat over metal lath 3/8 inch thick to comply with ASTM C926.
- D. Coat backs of units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of units as they are set. Tap units into place, completely filling space between units and scratch coat.
- E. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly, and allow it to become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Concave for thin brick unless otherwise indicated.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged brick.
 - 2. Defective joints.
 - 3. Brick masonry not matching approved samples.
 - 4. Brick masonry not complying with other requirements indicated.
- B. Replace in a manner that results in brick masonry matching approved samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: brick masonry as work progresses with soap and water, using sponges and soft brushes, and as recommended by brick manufacturers recommendations. Remove mortar fins and smears before tooling joints. This should be done prior to the mortar materials drying on the surface.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
 - 1. Acidic cleaners shall not be used for brick materials. After mortar is thoroughly set and cured, clean masonry only as directed by brick manufacturers cleaning guidelines.
 - 2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 3. Test cleaning methods on inconspicuous area; leave one-half of area uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning masonry.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - 5. Clean masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Brick: Stack excess brick where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in greatest dimension.
 - 2. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.16

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel framing and supports for equipment.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Steel girders for supporting wood frame construction.
7. Steel pipe columns for supporting wood frame construction.
8. Slotted channel framing.
9. Shelf angles.
10. Metal ladders.
11. Alternating tread devices.
12. Elevator pit sump covers.
13. Trash area gates.
14. Metal bollards.
15. Loose bearing and leveling plates for applications where they are not specified in other Sections.

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

1. 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 for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
3. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 COORDINATION

- ##### **A.**
- Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Fasteners.
 - 3. Shop primers.
 - 4. Shrinkage-resisting grout.
 - 5. Slotted channel framing.
 - 6. Manufactured metal ladders.
 - 7. Alternating tread devices.
 - 8. 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. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for countertops.
 - 2. Steel tube reinforcement for low partitions.
 - 3. Steel framing and supports for mechanical and electrical equipment.
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 5. Steel girders for supporting wood frame construction.
 - 6. Steel pipe columns for supporting wood frame construction.
 - 7. Shelf angles.
 - 8. Metal ladders.
 - 9. Elevator pit sump covers.
 - 10. Metal bollards.
 - 11. Loose steel lintels.
- C. Delegated-Design Submittal: For ladders, and alternating tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and alternating tread devices.
- B. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled-Stainless Steel Floor Plate: ASTM A793.

- G. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallicly bonded to steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Harsco Industrial IKG, a Division of Harsco Corporation.
 - b. Ohio Gratings, Inc.
 - c. W.S. Molnar Company.
 - 2. Source Limitations: Obtain floor plate from single source from single manufacturer.
- H. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- K. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. 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/F1941M, 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.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. 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.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- 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/D1187M.
- G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. 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 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work 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. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.

- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Provide bearing plates welded to beams where indicated.
 - 2. Drill or punch girders and plates for field-bolted connections where indicated.
 - 3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- D. 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.
 - 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 - 2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.
- E. Galvanize miscellaneous framing and supports where indicated.
- F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 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 and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch-diameter, steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.

5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Galvanize exterior ladders, including brackets.
9. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.9 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lapeyre Stair Inc.
 - b. Precision Ladders, LLC.
 1. Tread depth is not to be less than 8-1/2 inches exclusive of nosing or less than 10-1/2 inches, including the nosing, tread width is not to be less than 7 inches, and riser height is not to be more than 8 inches.
 2. Fabricate from steel and assemble by welding or with stainless steel fasteners.
 3. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
- B. Prime steel alternating tread devices, including treads, railings, brackets, and fasteners.
- C. Finish steel alternating tread devices, including treads, railings, brackets, and fasteners, with powder coat finish.
 1. Color: As selected by Architect from manufacturer's full range.

2.10 ELEVATOR PIT SUMP COVERS

- A. Fabricate from 3/16-inch abrasive-surface floor plate with four 1-inch-diameter holes for water drainage and for lifting.
- B. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch in least dimension.
- C. Provide steel angle supports unless otherwise indicated.

2.11 TRASH AREA GATES

- A. General: Fabricate trash area gates framed of hot dip galvanized steel tube; 3x2x1/4 frame with horizontal mid rail and diagonal bracing to receive prefinished metal cladding. Gates shall be complete with hot dip galvanized steel tube jamb posts filled with concrete and set in 18 inch

diameter reinforced concrete piers, complete with welded on pin type hinges, latches and 3/4 inch cane bolts with 6 inch deep standard pipe sleeves in concrete for cane bolts in both the open and closed position with holder for the up position. Field paint all galvanized steel. Equip hinges with grease zerks as required to lubricate.

2.12 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
 - 1. Cap bollards with 1/4-inch-thick, steel plate with domed top.
 - 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 - 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch-thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel or stainless-steel pipe or tubing with 1/4-inch-thick, steel or stainless-steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- D. Prime steel bollards with zinc-rich primer.

2.13 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.

2.14 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. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.15 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.

2.16 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. 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 universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 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."
- E. 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.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

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.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor shelf angles securely to existing construction with expansion anchors or anchor bolts.
- C. 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.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.4 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.

3.5 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.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings.

1.2 COORDINATION

- A.** Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B.** Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.
10. Metal finishes.
11. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, and handrail. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- E. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

- 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

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

- 1. Doherty Steel, Inc. Paola, KS.
 - 2. Builders Steel. North Kansas City, MO.
 - 3. Midland Steel. Wathena, KS.
 - 4. Lico Steel. Kansas City, MO.
 - 5. KC Steel Werx Inc. Kansas City, MO.
 - 6. Kansas City Structural Steel. Kansas City, MO.

- B. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

- 1. Provide galvanized finish for exterior installations and where indicated.

- D. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 FASTENERS

- A. Fastener Materials:

- 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
 - 4. Finish exposed fasteners to match appearance, including color and texture, of railings.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, 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.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. 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.
- E. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- G. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- H. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- I. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- J. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- K. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows.
 - 1. Comply with SSPC-SP 16.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
 - 2. Do not apply primer to galvanized surfaces.

- F. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.7 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum decorative railings.

B. Related Requirements:

1. Section 055213 "Pipe and Tube Railings" for nonornamental railings fabricated from pipes and tubes.
2. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.

1.2 COORDINATION AND SCHEDULING

- A.** Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B.** Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

- A.** Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.
10. Metal finishes.

- B.** Shop Drawings: Include plans, elevations, sections, and attachment details.

- C.** Samples: For each type of exposed finish required.

- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups for each form and finish of railing, consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
 - C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- 2.2 METALS, GENERAL
- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
 - B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
- 2.3 ALUMINUM DECORATIVE RAILINGS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide Superior Aluminum Products, Inc.; Series 9P Aluminum Picket Railing or a comparable product by one of the following:
 - 1. Alumicorp, Inc.
 - 2. C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - 3. Julius Blum & Co., Inc.
 - 4. Livers Bronze Co.
 - 5. VIVA Railings, LLC.
 - B. Source Limitations: Obtain aluminum decorative railing components from single source from single manufacturer.
 - C. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 - D. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B221, Alloy 6063-T5/T52.
 - E. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
 - F. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
 - G. Plate and Sheet: ASTM B209, Alloy 5005-H32 or Alloy 6061-T6.
 - H. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
 - I. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Aluminum Railing Components: Type 304 stainless steel fasteners.
 - 2. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
 - 3. Dissimilar Metal Railing Components: Type 304 stainless steel fasteners.
 - 4. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
 - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, 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.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast stainless steel, center of handrail 2-1/2 inches from wall.
 - 1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.
- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. 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.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Epoxy Intermediate Coat: Complying with MPI#77 and compatible with primer and topcoat.
- F. Polyurethane Topcoat: Complying with MPI#72 and compatible with undercoat.

- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded or mechanical connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.
 - 1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending to smallest radius that will not result in distortion of railing member.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless steel sleeves with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- R. Toe Boards: Where indicated on Drawings, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Railing attachment fasteners shall not extend into balcony waterproofing membrane.
- B. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.

3.5 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
 - 6. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 REPAIR

- A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894 and ASTM E935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.9 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 061533 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood decking.

B. Related Requirements:

1. Section 072500 "Weather Barriers" for flexible flashing used with patio decking.
2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing used with patio decking.

1.2 DEFINITIONS

- A. Boards:** Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

- B. Dimension Lumber:** Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:**

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data:** For preservative-treated wood products.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates:**

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

- B. Certificates of Inspection:** Issued by lumber grading agency for exposed wood products not marked with grade stamp.

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

1. Preservative-treated wood products.
2. Decking fasteners.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.

1. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 19 percent.
2. Dimension Lumber: 19 percent.

2.2 WOOD DECKING

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

1. Configuration: Provide product with tongue-and-grooved edges designed for fastening with concealed decking fasteners.

B. Dimension Lumber Decking:

1. Construction or No. 2 grade and any of the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWP.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWP.
 - c. Mixed southern pine; SPIB.

C. Radius-Edged Board Decking: 1-1/4-inch actual thickness of any of the following species and grades:

1. Douglas fir-larch or Douglas fir-south, Patio 2; WWPA.
2. Douglas fir-larch, Commercial Dex; WCLIB.
3. Douglas fir-larch (North), Commercial Patio; NLGA.
4. Hem-fir, Patio 2; WWPA.
5. Hem-fir, Commercial Dex; WCLIB.
6. Hem-fir (North), Commercial Patio; NLGA.
7. Southern pine, Standard; SPIB.
8. Western red cedar, Patio 2; WWPA.
9. Western red cedar, Commercial Dex; WCLIB.
10. Western red cedar (North), Commercial Patio; NLGA.

2.3 DIMENSION LUMBER FRAMING

A. Deck Framing:

1. Construction or No. 2 grade and any of the following species:
 - a. Hem-fir (North); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Mixed southern pine; SPIB.
 - e. Spruce-pine-fir; NLGA.
 - f. Douglas fir-south; WWPA.
 - g. Hem-fir; WCLIB or WWPA.
 - h. Douglas fir-larch (North); NLGA.
 - i. Spruce-pine-fir (South); NeLMA, WCLIB, or WWPA.

2.4 PRESERVATIVE-TREATED LUMBER

- A. Pressure treat boards and dimension lumber with waterborne preservative in accordance with AWWPA U1; Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
- B. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 1. Do not use chemicals containing arsenic or chromium.
- C. Use process for boards and dimension lumber that includes water-repellent treatment.
- D. Use process for boards and dimension lumber that does not include water repellents or other substances that might interfere with application of indicated finishes.
- E. After treatment, redry and to 19 percent maximum moisture content.
- F. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
- G. Application: Treat items indicated on Drawings and the following:
 1. Framing members less than 18 inches above grade.
 2. Sills and ledgers.

3. Members in contact with masonry or concrete.
4. Decking.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 1. Use stainless steel unless otherwise indicated.
 2. For pressure-preservative-treated wood, use stainless steel fasteners.
 3. For wood decking, use stainless steel fasteners where fasteners are exposed to view.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon-Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with ASTM F594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.
- G. Postinstalled Anchors: Stainless steel anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing in accordance with ASTM E488 conducted by a qualified independent testing and inspecting agency.
 1. Stainless steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.6 CONCEALED DECKING FASTENERS

- A. Deck Splines: Corrosion-resistant metal or plastic splines that fit in grooves routed into the sides of decking material and are fastened to deck framing with screws. Splines provide uniform spacing of decking material.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grabber Construction Products, Inc.
 - b. Ipe Clip Fastener Company Inc. (The).
 - c. M. M. Products, Inc.
 - d. Titan Metal Werks, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install wood decking with crown up.
- D. Secure decking to framing with deck splines or screws.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Apply copper naphthenate field treatment to comply with AWPAC M4, to cut surfaces of preservative-treated lumber.
- I. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES AC70 for power-driven fasteners.
 - 2. "Fastening Schedule" in ICC's International Building Code.
 - 3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.
- J. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.
- K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 INSTALLATION OF ELEVATED DECK JOIST FRAMING

- A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- C. Lap members framing from opposite sides of beams or girders not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- D. Provide solid blocking of 2-inch nominal thickness by depth of joist at intervals of 96 inches o.c., between joists.

END OF SECTION 061533

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 099000 "Painting" for priming and backpriming of interior finish carpentry.

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples: For each exposed product and for each color and texture specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and

HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's 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, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.
- D. MDF: ANSI A208.2, Grade 130.
- E. Particleboard: ANSI A208.1, Grade M-2.

2.2 INTERIOR TRIM

- A. Lumber Trim for Opaque Finish (Painted Finish):
 - 1. Species and Grade: Paint Grade Pine.
 - 2. Maximum Moisture Content for Softwoods: 19 percent.
 - 3. Maximum Moisture Content for Hardwoods: 10 percent.
 - 4. Finger Jointing: Allowed, unless otherwise noted.
 - 5. Face Surface: Surfaced (smooth), S4S.
 - 6. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber. Provide all exposed surfaces planed or sanded smooth.
- B. Trim Options:
 - 1. Base (Common Areas): PRL634 3-inch, primed.
 - 2. Base (Apartment Interiors): PRL634 3-inch, primed.
 - 3. Base Shoe (Apartment Interiors): PR126 1/2-inch by 3/4-inch, primed.
 - 4. Crown/Cove (Apartment Interiors): 425 4-1/4-inch MDF, primed.
 - 5. Door and Window Casing (Apartment Interiors): PR356 2-1/4-inch, primed.

6. Window Casing at apron (Apartment Interiors): PR356 2-1/4-inch, primed.
7. Window Sills: PR1021 9/16-inch by 7-1/4-inch, primed.
8. Trim below countertops: PR126 1/2-inch by 3/4-inch, primed.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

2.4 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 1. Interior standing and running trim, except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than 24 inches long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. Cope or Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 - 4. Use scarf joints for end-to-end joints.
 - 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 6. Install trim after gypsum-board joint finishing operations are completed.
 - 7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 - 8. Fasten to prevent movement or warping.
 - 9. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modified bituminous sheet waterproofing.
 - 2. Protection course.
 - 3. Molded-sheet drainage panels.

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: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING – FOUNDATIONS

- A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick,

polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Tamko Building Products, Inc; TW-60.
 - b. W.R. Meadows, Inc; Mel-Rol.
2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970/D1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C836/C836M.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E154/E154M.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
 - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E96/E96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING – BALCONIES

- A. Modified Bituminous Balcony Sheet Waterproofing: Minimum 60-mil nominal thickness, self-adhering sheet; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polyguard Products Inc; Polyguard Balconyguard Membrane.
 - b. Tamko Building Products, Inc; TW-60.
 - c. W.R. Meadows, Inc; Mel-Rol.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum, ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F: ASTM D1970/D1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C836/C836M.
 - e. Puncture Resistance: 40 lbf minimum: ASTM E154/E154M.
 - f. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D5385.
 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 ACCESSORIES FOR WATERPROOFING

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid solvent-borne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch, predrilled at 9-inch centers.
- G. Protection Course, Asphaltic: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - 1. Thickness: Nominal 1/4 inch.
 - 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 400.
 - b. Carlisle Coatings & Waterproofing Inc; Carlisle Construction Materials; CCW MiraDRAIN 6200.
 - c. CETCO; Aquadrain 15XP.
 - d. GCP Applied Technologies Inc.; Hydroduct 220.
 - e. ISI Building Products; AquaCheck DB 1500.
 - f. Polyguard Products, Inc.; Polyflow 10-P.
 - g. Urethane Polymers International, Inc.; EZE-DRAIN V-2.
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-

punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 420.
 - b. Carlisle Coatings & Waterproofing Inc; Carlisle Construction Materials; CCW MiraDRAIN 6000.
 - c. CETCO; Aquadrain 10X.
 - d. GCP Applied Technologies Inc.; Hydroduct 200.
 - e. ISI Building Products; AquaCheck DB 1000.
 - f. Polyguard Products, Inc.; Polyflow 10 for vertical surfaces.
 - g. Polyguard Products, Inc.; Polyflow BD for balconies.
 - h. Soprema, Inc.; Sopradrain 10G.
 - i. Urethane Polymers International, Inc.; EZE-DRAIN V.
 - j. W.R. Meadows, Inc; Mel-Drain.

- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 sieve, laminated to one side of the core, without a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than 2.8 gpm per ft.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 700.
 - b. Carlisle Coatings & Waterproofing Inc; Carlisle Construction Materials; CCW MiraDRAIN 9000.
 - c. CETCO; Aquadrain 20H.
 - d. Polyguard Products, Inc.; Polyflow 18.
 - e. Soprema, Inc.; Sopradrain 18G.
 - f. Urethane Polymers International, Inc.; EZE-DRAIN HD.
 - g. W.R. Meadows, Inc; Mel-Drain.

2.5 INSULATION DRAINAGE PANELS

- A. Insulation: Comply with Section 072100 "Thermal Insulation" for general building insulation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

3.2 INSTALLATION OF MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.

3.3 INSTALLATION OF MOLDED-SHEET DRAINAGE-PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.4 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyurethane waterproofing.
2. Molded-sheet drainage panels.
3. Insulation drainage panels.

B. Related Requirements:

1. Section 093013 "Ceramic Tiling" for fluid-applied waterproof membranes beneath ceramic tiles.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Minimum curing period.
 - c. Forecasted weather conditions.
 - d. Special details and sheet flashings.
 - e. Repairs.
 - f. Field quality control.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings:

1. Indicate locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. Flashing sheet, 8 by 8 inches.
2. Membrane-reinforcing fabric, 8 by 8 inches.
3. Drainage panel, 4 by 4 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A manufacturer-approved firm with minimum three years experience in installation of specified products in successful use on similar projects, employing workers trained by manufacturer, including a full-time on-site supervisor with a minimum of three years experience installing similar work, and able to communicate verbally with Contractor, Architect, and employees.
- B. Manufacturer Qualifications: A qualified manufacturer, with minimum five years experience in manufacture of waterproofing as one of its principal products. Shall also have local rep available for field inspections at the beginning of project to verify compliance with manufactures installation requirements.
 - 1. Manufacturer's product submitted has been in satisfactory operation on five similar installations for at least five years.
 - 2. Approval of Manufacturers and Comparable Products: Prime bidder must submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Completed and signed Substitution Request form.
 - b. Product data, including certified independent test data indicating compliance with requirements.
 - c. Sample shop drawings from similar project.
 - d. Project references: Minimum of five installations of similar system not less than five years old, with Owner and Architect contact information.
 - e. Name and resume of proposed qualified Inspector.
 - f. Sample warranty.
- A. Waterproofing Inspector Qualifications: An independent party certified as a waterproofing inspector by the SWRI or other certifying organization acceptable to Architect, retained by the Contractor and experienced in the installation and maintenance of the specified waterproofing system, qualified to perform observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification.
- B. Testing Agency Qualifications: Qualified independent agency experienced in the installation of the specified waterproofing system, and qualified to perform observation and inspection specified in Field Quality Control Article to determine Installer's compliance with the requirements of this Project, acceptable to Architect, retained by the Contractor.

1.6 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build mockup for each typical waterproofing installation, including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: 150 sq. ft. in area.
 - b. Description: Each type of installation.
 - c. Include examples of surface preparation, crack and joint treatment, wall-footing junctures, wall corners, horizontal and vertical piping sleeving and conduit, deck drains and other similar penetrations, waterproofing application, and flashing, transition, and termination conditions, to set quality standards for execution.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
 1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain waterproofing materials from single source and from single manufacturer.

2.2 POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C836/C836M and coal-tar free.
 1. Products: Provide waterproofing products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing Division, Beachwood OH; (866) 321-6357; email: techresources@tremcoinc.com; www.tremcosealants.com, Local Rep: Patrick Geraghty, (913) 226-1941, comparable products of other manufacturer meeting performance requirements.

- a. Tremco Incorporated; TREMproof 250 GC.
 - 1) VOC Content: Less than 100 g/L, roller and self-leveling grades.
 - 2) VOC Content: Less than 160 g/L, trowel detailing grade.
 - 3) Water Vapor Permeance: 0.03 perm, maximum, ASTM E96/E96M.
 - 4) Hardness, ASTM D 2240: 70 – 80.
 - 5) Low Temperature Flexibility and Crack Bridging, ASTM C 1305: Pass.
 - 6) Adhesion in Peel, ASTM C 794: 26 lbf/in. (4553 N/m).
 - 7) Thickness: One coat 60 mils for vertical walls.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
- C. Sheet Flashing: 50-mil-minimum, nonstaining, uncured sheet neoprene.
 - 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
- F. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure; and as recommended by manufacturer for substrate and joint conditions.
- G. Backer Rod: Closed-cell polyethylene foam.

2.4 MOLDED-SHEET DRAINAGE PANELS (PROVIDE AT ALL LOCATIONS WHERE WATERPROOFING INSTALLED)

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 420.
 - b. Carlisle Coatings & Waterproofing Inc; Carlisle Construction Materials; CCW MiraDRAIN 6000XL.
 - c. W.R. Meadows, Inc; Mel-Drain.

2.5 INSULATION

- A. Insulation: Comply with Section 072100 "Thermal Insulation" for general building insulation.

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 concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
 - 1. Comply with ASTM C1193 for joint-sealant installation.
 - 2. Apply bond breaker on sealant surface, beneath preparation strip.
 - 3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.
- B. Install sheet flashing and bond to deck and wall substrates where required in accordance with waterproofing manufacturer's written instructions.
 - 1. Extend sheet flashings for 4 inches onto perpendicular surfaces and items penetrating substrate.

3.5 INSTALLATION OF WATERPROOFING

- A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 60 mils.
 - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft.
- E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install thermal insulation specified in Section 072100 "Thermal Insulation" before installing drainage panels.
- B. Molded-Sheet Collector-Panel System: Install in accordance with manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections:
 - 1. Testing agency to verify thickness of waterproofing during application for each 600 sq. ft. of installed waterproofing or part thereof.
 - 2. Flood Testing: Flood test each deck area for leaks, in accordance with procedures in ASTM D5957, after completing waterproofing but before placing overlaying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and a maximum depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 - b. Flood each area for 48 hours.
 - c. Testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
 - 3. Electronic Leak-Detection Testing:
 - a. Testing agency to test each deck area for leaks using an electronic leak-detection method that locates discontinuities in the waterproofing membrane.
 - b. Testing agency to perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.
 - c. Testing agency to create a conductive electronic field over the area of waterproofing to be tested and electronically determine locations of discontinuities or leaks, if any, in the waterproofing.
 - d. Testing agency to provide survey report indicating locations of discontinuities, if any.
- B. Manufacturer's Field Service: Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, and drainage components and to furnish daily reports to Architect.
- C. Waterproofing will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 PROTECTION

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 071416

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.
5. Loose-fill insulation.
6. Spray-applied cellulosic insulation.

B. Related Requirements:

1. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
2. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
3. Section 072500 "Weather Barrier" for building wrap.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.
5. Loose-fill insulation.
6. Spray-applied cellulosic insulation.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 for Class A materials, 75 and 450 for Class B materials, and 200 and 450 for class C materials, when tested in accordance with ASTM E84.
- B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- E. Thermal-Resistance Value (R-Value): R-value as indicated below in accordance with ASTM C518 and IBC Energy Code, current adopted edition.
 - 1. R-Value at exterior 6-inch stud walls: R-20.
 - 2. R-Value at perimeter below-grade walls: R-7.5 ci.
 - 3. R-Value at roof/ceiling: R-38.
 - 4. R-Value at garage to unit/conditioned space adjacent: R-20.
 - 5. R-Value at garage to unit above: R-30.
 - 6. R-Value at slab on grade unheated: R-10 for 24-inches.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DiversiFoam Products; CertiFoam 25 SE.
 - b. Dow Chemical Company (The); Dow Styrofoam SE.
 - c. Owens Corning; Foamular 250.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DuPont de Nemours, Inc.
 - b. Elevate; Holcim Building Envelope.
 - c. Hunter Panels; a Carlisle company.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. The Dow Chemical Company.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. Elevate; Holcim Building Envelope.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Rmax, A Business Unit of Sika Corporation.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Glass-Fiber Blanket Insulation, 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).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 MINERAL WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Owens Corning.
 - c. ROCKWOOL.

2.6 LOOSE-FILL INSULATION

- A. Glass-Fiber Loose-Fill Insulation: ASTM C764, Type I for pneumatic application or Type II for poured application.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 2. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

2.7 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hamilton Manufacturing Inc.
 - b. International Cellulose Corp.
 - c. US Greenfiber, LLC.

2.8 INSULATION FASTENERS

A. Sealing Fasteners for Attachment of Continuous Insulation:

1. Basis of Design: Grip-Deck TubeSeal Fasteners System as manufactured by TRUFAST Walls.
2. Application: Seal blind fastener penetrations of a WRB or air-barrier behind the layer of continuous insulation.
3. Description: Pre-assembled fastener units consisting of:
 - a. Pre-assembled Thermal-Grip washer with Grip-Deck screw (available in various length and thread/tip types for steel or wood substrates) and TubeSeal gasketing tube of varying lengths for insulation thickness ranging from 1 to 4.5 inches thickness.
 - b. Flexible perimeter flattens without tearing insulation facer for air-barrier performance.
 - c. UV Inhibitor for exposure protection during course of construction.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide the following:
 - a. AGM Industries, Inc; Series T TACTOO Insul-Hangers.
 - b. Gemco; Spindle Type.
2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Gemco; 90-Degree Insulation Hangers.
2. Angle: Formed from 0.030-inch-thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

D. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc; RC150 or SC150.
 - b. Gemco; R-150 or S-150.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
- E. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space between face of insulation and substrate to which anchor is attached.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Gemco; Clutch Clip.
- F. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc; TACTOO Adhesive.
 - b. Gemco; Tuff Bond Hanger Adhesive.

2.9 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. 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.
- C. 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 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. 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.
- F. Below grade Polystyrene board shall be installed with tightly butted joints. For exterior face of grade beam installation, insulation board may be spiked to the unformed trench sides, prior to pouring, (not encroaching on required minimum width,) if ground is firm. For installation to post formed walls, spot dabs of adhesive (compatible with waterproofing if present) may be installed. For below slab installations, lay on compacted drainage layer flattened and compacted for uniform bearing.
- G. The drawings and specifications give general information as to areas to receive thermal insulations. However, there will be areas not shown or described where insulations will obviously be necessary, and occasionally drawing details are shown without the insulation, for clarity of the detail. Therefore, irrespective of any omissions of detail or description, for every area where heat losses and vapor transmissions can occur between heated and non-heated spaces, Contractor shall provide insulation and vapor barrier cutoff equal to other similar installations in the building and as necessary to provide a completely insulated and vapor resistant installation.
- H. All mud sills shall be set on sill sealer.
- I. Care shall be taken to chink spaces around doors, windows, and other penetrations full of fiberglass fibers.
- J. Comply with manufacturer's instructions for particular conditions of installation in each case.
- K. Set vapor barrier faced units with vapor barrier to winter warm side of construction, except as otherwise shown. Do not obstruct ventilation spaces, except for fire-stopping.
- L. Insulation Contractor shall provide means of protecting recessed lighting in attic space from coming in contact with insulation. This protection should be in the form of a framed surround at each fixture to keep insulation from touching fixture and consequently avoid overheating.
- M. Location specific information:
 - 1. Batt insulation in all 2 x 6 exterior walls shall be 5-1/2-inch thick, R-20, Kraft faced fiberglass batts as required to fill the stud space in walls and unfaced bats in truss spaces at exterior walls.
 - 2. Insulation for rim joists on townhomes shall have a minimum of R-13.
 - 3. Batt or blown-in fiberglass insulation in all ceilings adjacent to apartment, garage work space and clubhouse attic spaces shall be thickness required to achieve R-38 rating. For

townhome ceilings, flat ceilings and attics shall have an R-49 minimum. Provide a vapor retarder having a transmission rate not exceeding 1 perm in accordance with ASTM E 96 installed on the warm side of the attic insulation.

4. Batt fiberglass insulation in garage ceilings adjacent to conditioned spaces shall be thickness required to achieve R-30 minimum rating and shall be full depth of cavity.
5. Fiberglass insulation shall be installed between ceilings and floor deck truss spaces minimum 3-1/2-inch thick at all wood truss supported floor levels.
6. Sound control batt insulation in both walls of partitions separating apartment units as well as corridor, stairway, elevator hoistway and elevator control room walls, clubhouse toilet rooms and offices, and all walls and ceilings indicated to receive acoustical batt insulation shall be QuietZone fiberglass acoustic batts, 3-1/2-inch and 5-1/2-inch thick, as required to fill the stud space. R-11 insulation for 2 x 4 demising walls, corridor walls, stair and elevator walls. R-19 insulation for 2 x 6 demising walls, corridor walls, stair and elevator walls.
7. Sill sealer shall be ProPink ComfortSeal, 3-1/2-inch or 5-1/2-inch wide by 1/4-inch-thick polyethylene sill plate gasket as manufactured by Owens Corning, or Styrofoam Brand Sill Seal by Dupont.
8. At the Clubhouse, Units and Public Spaces, open cell spray fill voids at rough openings of all doors, windows, and wall penetrations to the exterior, with low pressure expanding open cell spray foam insulation, or mineral wool and fire/smoke rated exterior paintable sealant assembly for fire rated walls.

3.3 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 36 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.4 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 as follows:
 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.

5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 2. Press units firmly against inside substrates.
 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."
- B. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.
 1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 2. Press units firmly against inside substrates.

3.6 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 clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 6. 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.
 7. 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 the interior of construction.

- 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.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Loose-Fill Insulation: Apply according to ASTM C1015 and manufacturer's written instructions.
 - 1. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
- D. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions.
 - 1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
 - 2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.
2. Open-cell spray polyurethane foam insulation.
3. Accessories.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by qualified testing agency.

B. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Spray Foam Insulation.
 - b. Henry Company.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Master Builders Solutions.
 - e. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Spray Foam Insulation.
 - b. Henry Company.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Master Builders Solutions.
 - e. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.
 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 ACCESSORIES

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 1. Gypsum Wallboard: 1/2-inch minimum thickness.
 2. Materials tested in accordance with and complying with acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.
 3. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Flame Control Coatings, LLC.
 - 2) International Fireproof Technology Inc.
 - 3) No-Burn, Inc.

- 4) TPR2 Corporation.
4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
5. Topcoat: 8- to 12-mil-thick, heavy-duty protective coating recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings.
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- G. Install thermal barrier material.
 1. Do not cover insulation prior to any required spray foam insulation inspections.
- H. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
 1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Weather barrier assemblies.
2. Building wrap.
3. Weather barrier flashing.
4. Flexible flashing.
5. Fluid applied flashing.
6. Weather barrier accessories.
7. Drainage material.

B. Related Requirements:

1. Section 042200 "Concrete Unit Masonry" for masonry ties and flashing installation.
2. Section 044313.16 "Adhered Masonry Veneer" for flashing installation.
3. Section 072100 "Thermal Insulation" for installation of exterior insulation.
4. Section 074646 "Fiber-Cement Siding" for installation of fiber-cement board siding.

1.2 DEFINITIONS

A. Weather Barrier: A combination of materials and accessories that do the following:

1. Prevents the accumulation of water as a water-resistive barrier.
2. Minimizes the air leakage into or out of the building envelope as a continuous air barrier.
3. Provides sufficient water vapor transmission to enable drying as a vapor-permeable membrane.

B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly per International Building Code Section 1403.2.

C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.

D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).

E. Vapor Permeable Membrane: The property of having a water-vapor permance rating of 10 perms (575 ng/Pa x s x sq. m) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Manufacturer's Certified Installer, weather barrier manufacturer's designated field representative, and installers of work that interfaces with or affects weather barrier.
2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions, fastener types and spacings, etc.
3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements.
5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
6. Review weather barrier manufacturer's Project Warranty Registration and Observation process.
7. Review Construction Indoor Air Quality Management Plan "Moisture Protection for Absorbent Materials."
8. Review temporary protection requirements for weather barrier during and after installation, including repair techniques for repairing damaged areas.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer's product.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build integrated mockups of exterior wall assemblies of each substrate type and covering material, approx., 150 sq. ft. each, incorporating backup wall construction, external cladding, one window, storefront, door frame and sill, insulation, ties, conduit and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection, fenestration and wall interface.
 - b. Water test exterior wall with water spray apparatus for 15 minutes and check for leaks inside.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Manufacturer's Field Service: Register project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project registration and observation process.
- D. DuPont Building Knowledge Center Quality Assurance Program: Design review and quality assurance for DuPont 15-year Product and Labor Warranty eligibility.

1. Eligibility: Ensure project meets the definitions and criteria of a wood-framed multi-family/light commercial or commercial and high-performance building.
2. Design Review: Provide technical drawings and details for all above-grade exterior walls involving the use of DuPont Building Envelope Solutions Products to be reviewed by DuPont Building Envelope Specialist or weather barrier manufacturer's designated representative.
3. Preconstruction Meetings:
 - a. Ensure that DuPont Building Envelope Specialist and/or weather barrier manufacturer's designated field representative are present at all preconstruction and mock wall meetings.
 - b. Request installer training as needed by DuPont Building Envelope Specialist or weather barrier manufacturer's field representative.
4. Field Observation Meetings: During construction process and prior to façade/cladding installation, contractor and/or subcontractor to coordinate 2 field observation meetings with DuPont Building Envelope Specialist or weather barrier manufacturer's designated field representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store near heat source or open flame.

1.6 WARRANTY

- A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
 1. Warranty Period: 10 years from date of purchase.
- B. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limits.
 1. Warranty Period: 15 years from date of purchase.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.8 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.
- B. Manufacturer's Instructions: For installation of each product specified.

- C. Qualification Data: For Installer, laboratory, mockup testing agency, and field testing agency.
- D. Sample Warranty: For manufacturer's warranty.
- E. Reports: Field test and inspection reports.
- F. Installer's weather barrier manufacturer-training certificate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain weather barrier assembly components, including weather barrier flashing and foam insulation from same manufacturer as weather barrier or manufacturer approved by weather barrier manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures, without failure due to defective manufacture of products, per the International Building Code and as noted on the Structural Drawings.
- B. High-Performance Installations:
 - 1. For installation with one of the following building envelope performance or structural characteristics:
 - a. Exceeding 65 mph (100 km/h) equivalent structural load.
 - b. Exceeding 15 mph (24 km/h) equivalent wind-driven rainwater infiltration.
 - c. Buildings with 60 feet (18 m) or more total height above grade plane, as defined in the International Building Code.
 - d. Construction with gypsum or cement-based exterior sheathing.
 - e. Non-wood based primary structure such as: steel, light gage steel, masonry or concrete.

2.3 WEATHER BARRIER

- A. Building Wrap: ASTM E2556/E2556M, Type II 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. Products: Subject to compliance with requirements, provide the following:
 - a. DuPont de Nemours, Inc.; DuPont™ Tyvek® CommercialWrap® D.
 - 1) System Description, Single-Layer Drainable: Single-layer weather barrier with integral drainage, including flashing and sealing of penetrations and seams.
 - a) Primary Layer: Commercial building wrap “D” with integral drainage installed closest to building interior.

2. Water-Vapor Permeance: Not less than 23 perms per ASTM E96/E96M, Desiccant Method (Procedure A), or not less than 28 perms per ASTM E96/E96M, Water Method (Procedure B).
 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E2178.
 4. Drainage: Not less than 90 percent when tested in accordance with ASTM E2273.
 5. Allowable UV Exposure Time: Not less than three months.
 6. 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.

2.4 WEATHER BARRIER FLASHING

- A. Conformable Weather Barrier Flashing: Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 deg F (80 deg C) for 7 days.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; FlexWrap™ NF or comparable product by Architect approved manufacturer.
 2. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
 3. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E 331.
 4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 degrees F (minus 4 deg C) as Class A (without primer use).
 5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.
- B. Strip Flashing: Composite flashing material composed of spunbonded polyethylene laminate with 100 percent butyl-based, dual-sided, adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure, 176 deg F (80 deg C) for 7 days.
1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; StraightFlash™ and VersaFlange™ for non-flanged windows and like assemblies or comparable product by Architect approved manufacturer.
 2. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E 331.
 3. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (minus 4 deg C) as Class A without primer use.
 4. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

2.5 FLUID-APPLIED FLASHING

- A. Fluid-Applied Flashing: Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied Flashing & Joint Compound+.
2. VOC Content: ASTM C 1250, less than 2 percent by weight and between 25 to 30 g/L.
3. Water Vapor Transmission: ASTM E 96, Method B, greater than 20 perms (1100 ng/Pa x s x sq. m) at 25 mils (0.635 mm) thick.
4. Minimum Tensile Strength: ASTM D 412, 165 lb/sq. ft. (1140 kPa)
5. Minimum Elongation at Break: ASTM D 412; 360 percent.

2.6 WEATHER BARRIER ACCESSORIES

- A. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by weather barrier manufacturer for sealing joints and penetrations in commercial building wrap.
 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Tape.
- B. Closed-Cell Polyurethane Foam Insulation: Low pressure, low expansion, single component polyurethane foam, with maximum flame-spread and smoke-developed indexes of 15 and 25, respectively, per ASTM E 84.
 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; DuPont™ Window & Door Foam.
 2. Pressure Build-Up: 0.0247 psi (0.170 kPa) maximum, AAMA 812.
 3. Deflection: 0.0050-inch (0.127 mm) maximum, AAMA 812.
- C. Fasteners with Self-Gasketing Washers: Commercial building wrap manufacturer's recommended pneumatically or hand-applied fasteners with 1-inch- or 2-inch- diameter, high-density polyethylene cap washers with UV inhibitors, as required by location.
 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Wrap Caps.
- D. Primer for Flashings: Synthetic rubber-based product; spray applied. Strengthen adhesive bond at low temperature applications between weather products such as self-adhered flashing products, commercial building wraps, and common building sheathing materials.
 1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; DuPont™ Adhesive Primer.
 2. Peel Adhesion Test: Passes in accordance with ASTM D 3330, Test Method F, for the following.
 - a. Peel Angles: 0, 25, 72, and 180 degrees.
 - b. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.
 3. Chemical Compatibility: Pass; AAMA 713.
 4. Flame Spread Index: 5; ASTM E 84.
 5. Smoke Development Index: 0; ASTM E 84.

2.7 DRAINAGE MATERIAL

- A. Rainscreen Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane with thickness not less than 10mm and shall be used under siding and adhered masonry veneer.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. 10mm Sure Cavity Rainscreen by Masonry Technology Inc. (MTI)
 - 2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements.
- B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.
 - 1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.
- C. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
 - 1. Maintain continuity of air and water barrier assemblies.
 - 2. Start weather barrier installation at a building corner, leaving 12 inches of weather barrier extended beyond corner to overlap.
 - 3. Install weather barrier horizontally starting at lower portion of wall surface.
 - 4. Provide minimum 6 inches overlap at horizontal- and vertical-wrap seams in a shingle manner to maintain continuous downward drainage plane and air and water barrier.
- B. Seams: Seal seams with building wrap tape per manufacturer's recommended installation instructions.
 - 1. Shiplap horizontal seams in weather barrier to facilitate proper drainage.
- C. Fasteners: Use weather barrier manufacturer's recommended capped fasteners to secure weather barrier and install fasteners according weather barrier manufacturer's installation guidelines.
 - 1. Do not use temporary fasteners to permanently attach weather barrier.
 - 2. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
 - 3. Install fasteners with gasketing washers through flashing where recommended by manufacturer.

- D. Openings: Completely cover openings with weather barrier, then cut weather barrier membrane to openings according to weather barrier manufacturer's installation guidelines.
 - 1. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
 - 2. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
 - 3. Install flashing according to weather barrier manufacturer's installation guidelines.
- E. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch 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 overlap unless otherwise indicated.
- F. 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.
- G. Rough Openings: Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer's written instructions.
 - 1. Apply 6-inch- or 9-inch- wide conformable weather barrier flashing at door and window sills, as required by wall widths.
 - 2. Ensure that sill flashing does not slope to the interior.
 - 3. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.
 - 4. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer's instructions.
 - 5. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
 - 6. Use strip flashing with wrap cap screws to secure head flap of the windows.
- H. Penetrations: Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels.
 - 1. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.
- I. Terminations: Provide minimum 2 inches overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane.
 - 1. Secure weather barrier with fasteners and weather-barrier flashing.

3.3 FLUID-APPLIED FLASHING INSTALLATION

- A. General: Before installing fluid-applied flashing, do the following:

1. Ensure drainage path is not blocked or disrupted. Do not install on walls that do not feature a continuous path for moisture drainage. Blocked or disrupted paths for drainage can result in excess moisture buildup in wall cavity. Do not install below grade.
 2. Remove surface dust, dirt, and loose mortar.
 3. Verify that surface is free of grease and other contaminants and that surface is smooth.
 4. Fill joints in concrete masonry units, and voids in cast-in-place concrete with trowel-applied fluid-applied flashing to ensure surface is flush and smooth.
 5. Allow masonry mortar and cast-in-place concrete a minimum of 24 hours to cure before installing fluid-applied flashing.
- B. Fluid-Applied Flashing Installation: Using a trowel or brush, apply fluid-applied flashing around perimeter of window and door openings to a minimum thickness of 25 mils.
1. Extend flashing a minimum of 2 inches onto exterior face of adjacent surface.
 2. Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.
 3. Joint Applications: Using a trowel or a brush, fill cracks and voids up to 1/4 inch in width.
 - a. For joints and cracks between 1/4 and 1/2 inch wide, cover first with mesh tape.
 - b. For joints and cracks between 1/2 and 1 inch wide, cover first with butyl-based strip flashing.
 - c. Apply a bead, then trowel smooth.
 - d. Seam coverage should be a minimum of 2 inches wide and 15 to 20 mils thick.
 - e. Inspect for gaps and pinholes in fluid-applied flashing and apply additional coats until no gaps and pinholes appear.

3.4 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 4. Lap water-resistive barrier over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.5 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to train installers and observe subject test-wall areas and installations.
- B. Testing Agency: Engage a qualified third-party testing agency to perform tests and inspections.

- C. Test Area: Perform tests on one bay at least 30 feet, by one story and mockups.
- D. Field Quality Control Testing: Perform the following tests.
 - 1. Air Infiltration Whole Building: ASTM E 779 at not more than 0.25 cfm/sq. ft. at 1.57 lb/sq. ft (75 Pa).
 - 2. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" article, but not less than 2.86 lbf/sq. ft. No water penetration shall occur as defined in ASTM E 1105.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 30, and 70 percent completion.
- E. Prepare test and inspection reports.

3.7 CLEANING

- A. Immediately remove release paper and scrap from work area daily and dispose of material in accordance with requirements of General Contractor.

3.8 PROTECTION

- A. Protect installed weather barrier from the following:
 - 1. Damage from cladding, structure, or a component of the structure (e.g., window, door, or wall system).
 - 2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
 - 3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
 - 4. UV exposure in excess of products' stated limits.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Metal flashing and trim.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof ventilators.

1.2 DEFINITIONS

- A. Roofing Terminology:** See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Asphalt roofing cement.
5. Elastomeric flashing sealant.

B. Shop Drawings: For metal flashing and trim.

C. Samples: For each exposed product and for each color and blend specified, in sizes indicated.

1. Asphalt Shingles: Full size.
2. Ridge and Hip Cap Shingles: Full size.
3. Exposed Valley Lining: 12 inches square.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by manufacturer and witnessed by a qualified testing agency.

- C. Research Reports: For synthetic underlayment, from an agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes.
- D. Sample Warranty: For manufacturer's materials warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing Installer's warranty.

1.7 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. Asphalt Shingles: 100 sq. ft. of each type and in each color and blend, in unbroken bundles.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.
- B. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.11 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
2. Materials Warranty Period: 50 years from date of Substantial Completion, prorated, with first 10 years nonprorated.
3. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Certainiteed; SAINT-GOBAIN; Landmark Series or a comparable product by one of the following:
 - a. GAF.
 - b. Owens Corning.
 2. Strip Size: Manufacturer's standard.
 3. Algae Resistance: Granules resist algae discoloration.
 4. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.4 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
 1. ASTM D226/D226M: Type I.
- B. Self-Adhering Ice and Watershield Underlayments shall be one of the following options, 1 or 2:
 1. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; evaluated and documented to be suitable for use as a roof

underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.

a. Products: Subject to compliance with requirements, provide the following:

1) MFM Building Products Corporation; IB-3 Ice Buster.

2. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 55-mil-thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; SAINT-GOBAIN; WinterGuard Granular Waterproofing Underlayment or a comparable product by one of the following:

1) GAF.

2) GCP Applied Technologies Inc.

3) Owens Corning.

b. Top Surface: Granule.

C. Granular-Surfaced Valley Lining: ASTM D3909/D3909M, mineral-granular-surfaced, glass-felt-based, asphalt roll roofing; 36 inches wide.

2.5 RIDGE VENTS

A. Ridge Vent: Lomanco Lo-OmniRoll Model LOR-30, UV-stabilized plastic ridge vent for use under ridge shingles.

2.6 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.

C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through sheathing less than 3/4 inch thick.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch-minimum diameter.

1. Provide with minimum 0.0134-inch-thick metal cap, 0.010-inch-thick power-driven metal cap, or 0.035-inch-thick plastic cap; and with minimum 0.083-inch-thick ring shank or 0.091-inch-thick smooth shank of length to penetrate at least 3/4 inch into roof sheathing or to penetrate through roof sheathing less than 3/4 inch thick.

- E. Roof Vents shall be Lomanco slant top 750 series color as selected by Architect. Quantities and locations as required for required ventilation rates.
- F. Kick-Out Diverter Flashing: Provide DryFlekt TPO diverter flashing water management system, in color to match adjacent wall/gutters.

2.7 METAL FLASHING AND TRIM

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Prefinished aluminum.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.
 - 1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 - 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
 - 3. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of 18 inches beneath upslope asphalt shingles and 6 inches beyond each side of exterior wall and 6 inches above the roof plane.
 - 4. Counterflashings: Fabricate to cover 4 inches of base flashing measured vertically; and in lengths required so that no step exceeds 8 inches and overall length is no more than 10 feet.
 - a. Provide metal reglets or receivers for installation.
 - 5. Open-Valley Flashings: Fabricate from metal sheet not less than 24 inches wide in lengths not exceeding 10 feet, with 1-inch- high, inverted-V profile water diverter at center of valley and equal flange widths of not less than 11 inches.
 - a. Hem flange edges for fastening with metal cleats.
 - b. Add stiffening ribs in flashings to promote drainage.
 - 6. Drip Edges: Fabricate in lengths not exceeding 10 feet with minimum 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
 - 7. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Asphalt-Saturated Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
1. Single-Layer Installation:
 - a. Lap sides a minimum of 4 inches over underlying course.
 - b. Lap ends a minimum of 4 inches.
 - c. Stagger end laps between succeeding courses at least 72 inches.
 2. Install felt underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of felt over self-adhering sheet not less than 4 inches in direction that sheds water.
 - b. Lap ends of felt not less than 6 inches over self-adhering sheet.
 - c. Install fasteners at no more than 36 inches on center.
 3. Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.
 4. Terminate felt extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.
- C. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water.
 - a. Lap sides not less than 4 inches.
 - b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
 - c. Roll laps with roller.
 3. Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
 4. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
 5. Rakes: Extend from edges of rakes 36 inches beyond interior face of exterior wall.
 6. Valleys: Extend from lowest to highest point 18 inches on each side of centerline.
 7. Hips: Extend 18 inches on each side.

8. Ridges: Extend 36 inches on each side.
9. Sidewalls: Extend 18 inches beyond sidewalls and return vertically against sidewalls not less than.
10. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches beyond penetrating elements and return vertically against penetrating elements not less than 4 inches.
11. Roof-Slope Transitions: Extend 18 inches on each roof slope.
12. Cover underlayment within seven days.

3.3 INSTALLATION OF METAL FLASHING AND TRIM

- A. Install metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Install metal flashings in accordance with recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
 2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over underlying shingle and up the vertical face.
 1. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle.
 2. Fasten to roof deck only.
- D. Cricket and Backer Flashings: Install against roof-penetrating elements extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of 4 inches secured in a waterproof manner.
 1. Install in reglets or receivers.
- F. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.
 2. Adhere minimum 9-inch-wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to underlying self-adhering sheet, polymer-modified bitumen sheet.
 - a. Place strips parallel to and over flanges so that they will be just concealed by installed shingles.
 3. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.
- G. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.

- H. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.
- I. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 INSTALLATION OF ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions, recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch over fascia at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of four roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.
 - 1. Locate fasteners in accordance with manufacturer's written instructions.
 - 2. Where roof slope exceeds 18:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 3. Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 4. When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- E. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley.
 - 1. Use one-piece shingle strips without joints in valley.
 - 2. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline.
 - 3. Trim upper concealed corners of cut-back shingle strips.
 - 4. Do not nail asphalt shingles within 6 inches of valley center.
 - 5. Set trimmed, concealed-corner asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
- F. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips.
 - 1. Maintain uniform width of exposed open valley from highest to lowest point.
 - 2. Extend shingle a minimum of 4 inches over valley metal.
 - 3. Set valley edge of asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.

4. Do not nail asphalt shingles to metal open-valley flashings.
- G. Install ridge vents per manufacturer's installation instructions, continuous along the ridge from rake to hip or valley.
- H. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.
 1. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 073113

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fiber-cement siding, trim, and soffits.
- 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. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For fiber-cement siding and soffit including related accessories.

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 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.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. 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.

1.8 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: 30 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. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. James Hardie Building Products, Inc.
 - 1) All Hardie Board Products on this project shall be rated for use in Hardie Board Zone HZ5®.
- 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.
- A. Lap Siding: Boards in widths per Architectural Drawings of 12" thru 6.25", with exposures of 10.75" thru 5", and other sizes as noted and required.
 - 1. Texture: Smooth.
 - 2. Thickness: 0.312 inch.
- B. Trim Boards: Hardi Trim Boards shall be as detailed on the Architectural Drawings and selected from 4/4NTS and 5/4NTS, in 3/4" and 1" thicknesses and widths of 11.25", 9.25", 7.25", 5.5" or 3.5", or Artisan Trim in 1.5" thickness x 5.5" or 3.25" widths, as detailed.

1. Texture: Smooth.
- C. Factory Priming: Manufacturer's standard acrylic primer.

2.3 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. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. James Hardie Building Products, Inc.
- B. Nominal Thickness: Not less than 5/16 inch.
- C. Pattern: 12-inch-, 16-inch-, or 24-inch- wide sheets with smooth texture.
- D. Ventilation: provide ventilated and non-ventilated panels meeting Code required free air opening space.
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.4 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. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
1. Corner posts.
 2. Door and window casings.
 3. Fasciae.
 4. Moldings and trim.
- C. 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.
- D. Fasteners:
1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
 3. For fastening fiber cement, use hot-dip galvanized or stainless-steel fasteners.
- E. Insect Screening for Soffit Vents: Aluminum, 18-by-16 mesh.
- F. Spacer: 1/8-inch thick by 3-inch wide polyethylene foam product, or approved equal.

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 o.c.
- B. Install siding and trim materials with joints and spacings as indicated in manufacturer's instructions to allow for thermal and moisture movement requirements, and to provide properly designed sealant joints.
- C. Apply polyethylene foam insulation spacer vertically on the wall every 16 inches o.c. to align with studs and at all changes in wall directions to create a space between the insulation board and fiber cement.
- D. 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

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for manufactured copings and roof edge flashings.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

- A. Roofing Terminology:** Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference:** Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 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. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field Test Reports:

1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturers: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
 2. Installers: 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- 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.
 - 2. Zone 2 (Roof Area Perimeter): As indicated on structural drawings.
 - 3. Zone 3 (Roof Area Corners): As indicated on structural drawings.
- D. ENERGY STAR Listing: Roofing system to be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested in accordance with ANSI/CRRC S100.
- F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fabric-backed TPO sheet.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GAF; EverGuard® 60 mil TPO or a comparable product by one of the following:
 - a. Carlisle SynTec Incorporated; Carlisle Construction Materials.
 - b. Elevate; Holcim Building Envelope.
 - c. Versico Roofing Systems; Carlisle Construction Materials.
 - 2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
 - 3. Thickness: 60 mils, nominal.
 - 4. Exposed Face Color: Tan.

2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory 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 thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Slip Sheet: Manufacturer's standard, of thickness required for application.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- I. 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.
- J. 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. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated; Carlisle Construction Materials.
 - b. Firestone Building Products.
 - c. GAF.
 - d. Insulfoam; Carlisle Construction Materials Company.
 - 2. Compressive Strength: 20 psi.
 - 3. Size: 48 by 48 inches.
 - 4. Thickness: As required to achieve R-value of roof/ceiling assembly.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch.
 - 3. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. 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.
- D. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: 1/2 inch.

- E. 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 thick and acceptable to roofing system manufacturer.
 - 1. Size: Approximately 36 by 60 inches.
 - 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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify any damaged sections of wood decks have been repaired or replaced.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. 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, listed roof 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 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 joints staggered.
 - 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 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.
 - 1) Trim insulation so that water flow is unrestricted.
 - d. Fill gaps exceeding 1/4 inch with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - 3. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to wood decks.
 - a. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 - 4. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Install with long joints continuous and with end joints staggered not less than 12 inches 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 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.
 - 1) Trim insulation so that water flow is unrestricted.
- e. Fill gaps exceeding 1/4 inch with insulation.
- f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- g. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 2) 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 COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - b. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- B. Install slip sheet over cover board and beneath roof membrane.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

- 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.

3.7 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.

3.8 INSTALLATION OF WALKWAYS

- A. Flexible Walkways:
 - 1. Install flexible walkways at the following locations:

- a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
2. Provide 6-inch 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.

3.9 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

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed steep-slope roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 COORDINATION

- A.** Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B.** Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl 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.
12. Include details of concrete balconies on wood framed decks, edge forming, drips, flashings, pans, etc.

- C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. 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.
- E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 1. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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: 10 years for anodic finishes and 20 years for PVDF finishes from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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" and "Residential Sheet Metal Guidelines" 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, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

2. Color: As selected by Architect from manufacturer's full range.
3. 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.

- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

- B. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - b. GCP Applied Technologies Inc.
 - c. Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands).
 - d. Owens Corning.
 - e. Protecto Wrap Company.
 - f. SDP Advanced Polymer Products Inc.
 2. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

2.4 MISCELLANEOUS MATERIALS

- A. 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.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. 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 wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone 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.

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 on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- 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 deep, filled with butyl sealant concealed within joints.
- 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. 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.
- G. Do not use graphite pencils to mark metal surfaces.

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-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, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Gutter Profile: 6x6 inch Style K (Ogee) unless otherwise indicated on Drawings, in accordance with cited sheet metal standard.
6. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
 - a. Aluminum: 0.032 inch 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. Aluminum: 0.024 inch thick.

C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:

1. Aluminum: 0.032 inch 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. Aluminum: 0.032 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.

- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-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. Coping Profile: Fig. 3-4A in accordance with SMACNA's "Architectural Sheet Metal Manual."
 - 2. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
 - 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.040 inch thick.
- C. Roof Expansion-Joint Cover: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.034 inch thick.
- D. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- B. Valley Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- C. Drip Edges: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.9 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- 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 staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.

6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

3.3 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 o.c.
 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 1. Coat concealed side of uncoated-aluminum and stainless steel 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.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, 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.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 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. Downspouts:
1. Join sections with 1-1/2-inch 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 o.c.
 4. Provide elbows at base of downspout to direct water away from building.
 5. Connect downspouts to underground drainage system.
- C. 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.
 3. Loosely lock front edge of scupper with conductor head.
 4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 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.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. 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.

3.6 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.

3.9 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. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge drainage systems.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copings.
2. Roof-edge drainage systems.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. 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.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.

3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

D. Samples: For each type of roof specialty and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For copings, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special 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 FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 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 Delta E 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 Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with SPRI ES-1 and capable of resisting the following design pressures:
 - 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, 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, ambient; 180 deg F, material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATAS International, Inc.
 - b. Metal-Era, Inc.
 - c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - 2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.040 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 3. Corners: Factory mitered and continuously welded.

4. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
 - b. Face-Leg Cleats: Concealed, continuous stainless steel.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ATAS International, Inc.
 2. Metal-Era, Inc.
 3. PAC-CLAD; Peterson Aluminum Corporation; a Carlisle company.
- B. Downspouts: Plain rectangular complete with machine-crimped or mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Formed Aluminum: 0.040 inch thick.
- C. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
 1. Formed Aluminum: 0.063 inch thick.
- D. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, and built-in overflow.
 1. Formed Aluminum: 0.063 inch thick.
- E. Aluminum Finish: Two-coat fluoropolymer.
 1. Color: Match color of adjacent material.

2.4 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.5 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATAS International, Inc.
 - b. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - c. GCP Applied Technologies Inc.
 - d. Henry Company.
 - e. Owens Corning.
 - f. Polyglass U.S.A., Inc.
 - g. Protecto Wrap Company.
 - h. SDP Advanced Polymer Products Inc.
2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

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 Stainless Steel Sheet: Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone 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.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

E. Aluminum Extrusion Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- 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 staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. 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.

- B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, 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 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 and stainless steel 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 with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch 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.

3.4 INSTALLATION OF COPINGS

- 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 and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
 - 2. 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.

3.5 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

- A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspouts at grade to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- C. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal to scupper.
 - 2. Loosely lock front edge of scupper with conductor head.
 - 3. Seal exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below scupper discharge.

3.6 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 sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Heat and smoke vents.
3. Roof ventilators.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, alternating tread devices, and stairs for access to roof hatches.
2. Section 055213 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.2 COORDINATION

- A.** Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B.** Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories 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 Delta E 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. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Babcock-Davis; Personnel Roof Hatch (BRHP) or a comparable product by one of the following:
 - a. ACUDOR Products, Inc.
 - b. BILCO Company (The).

- c. Milcor; a division of Hart & Cooley, Inc.
- B. Type and Size: Single-leaf lid, 30 by 96 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: Baked enamel or powder coat.
 - 3. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
 - 1. Insulation: 2-inch-thick, polyisocyanurate board.
 - a. R-Value: 12.0 according to ASTM C1363.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 - 6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 1. Provide two-point latch on lids larger than 84 inches.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Height: 42 inches above finished roof deck.
 - 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 - 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 - 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 - 5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 - 6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 - 7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.

8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.

- a. Color: As selected by Architect from manufacturer's full range.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Manufacturer's standard.
4. Post: 1-5/8-inch-diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

- a. Color: As selected by Architect from manufacturer's full range.

2.3 HEAT AND SMOKE VENTS

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F fire-suppression system.

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

- a. Greenheck

- 1) Model WRH Louvered Penthouse with 14" high GPI roof curb.

2. Type and Size: Single-leaf lid, 24" x 24" (throat size).
3. Loads: Minimum 40-lbf/sq. ft. external live load and 30-lbf/sq. ft. internal uplift load.
 - a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.
4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and are FM Approved.
5. Curb, Framing, and Lid Material: Zinc-coated (galvanized) steel sheet.
 - a. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
6. Curb, Framing, and Lid Material: Aluminum sheet.
 - a. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
7. Construction:

- a. Insulation: 2-inch-thick, polyisocyanurate board.
 - 1) R-Value: 12.0 according to ASTM C1363.
 - b. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - c. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - d. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - e. Fabricate curbs to minimum height of 14 inches above roofing surface unless otherwise indicated.
 - f. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
8. Hardware: Manufacturer's standard stainless steel; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.

2.4 ROOF VENTILATORS – (Coordinate with MEP for proper installation)

- A. Low-Profile, Cylindrical-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by Active Ventilation Products, Inc.:
 - a. For Flat Roofs: Subject to compliance with requirements provide aluminum Pop Vent intake and curb mounted aluminum Aura Ventilator exhaust as manufactured by Active Ventilation Products, Inc. or approved equal. Model AV-18-C12 Aura Roof Vent Exhaust and PV-18-C12 Aura Roof Intake Vent and additional styles and sizes as required. Intakes and exhaust louvers shall be minimum 12 inches above roof level, and flashed in per roofing manufacturers written instructions and details.
 - b. For sloped roofs: Lomanco slant top 750 Series. Color as selected by Architect. Quantities and locations as required for ventilation rates.
 - 2. Construction: Integral base flange, vent cylinder, cylinder bird screen, and rain cap hood.
 - 3. Dimensions: As indicated on Drawings.
 - 4. Configuration: As indicated on Drawings.
 - 5. Bird Screens: Manufacturer's standard mesh with rewirable frame.
 - 6. Vent Cylinder, Base Flange, and Rain-Cap Hood Material: Aluminum sheet, of manufacturer's standard thickness.
 - 7. Finish: As selected by Architect from manufacturer's full range.

2.5 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation and mill phosphatized for field painting where indicated.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
 2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 3. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
 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 a minimum total dry film thickness of 0.5 mil.
- B. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
 2. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 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 a minimum total dry film thickness of 0.5 mil.
- C. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- D. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.
- E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.
- F. Steel Tube: ASTM A500/A500M, round tube.
- G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- H. Steel Pipe: ASTM A53/A53M, galvanized.

2.6 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- C. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- F. Underlayment:
 - 1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D4397.
 - 3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 - 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils 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.
- G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- I. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- J. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- 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 and stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof-Hatch Installation:
 - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 2. Attach safety railing system to roof-hatch curb.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.

D. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.
2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

E. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078123 - INTUMESCENT FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mastic and intumescent fire-resistive coatings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Mastic and intumescent fire-resistive coatings.
2. Substrate primers.
3. Reinforcing fabric.
4. Reinforcing mesh.
5. Topcoat.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of mastic and intumescent fire-resistive coating after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of mastic and intumescent fire-resistive coating.

C. Evaluation Reports: For mastic and intumescent fire-resistive coating, from ICC-ES.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fire protection from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carboline Company; a subsidiary of RPM International.
 - b. Hilti, Inc.
 - c. Isolatek International.
 - d. PPG Paints; PPG Industries, Inc.
 - e. Sherwin-Williams Company (The).
 - 2. Application: Designated for "interior general purpose" and "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
 - 3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
5. Finish: As selected by Architect from manufacturer's standard finishes.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Conduct tests according to mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- B. Clean substrates of substances that could impair bond of fire protection.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- F. Extend fire protection in full thickness over entire area of each substrate to be protected.
- G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

- H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- I. Cure fire protection according to mastic and intumescent fire-resistive coating manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fire protection to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
 - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings."
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fire protection will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fire protection that does not pass tests and inspections, and retest.
 - 2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

- A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping for through-penetrations and membrane penetrations through the following fire resistance rated assemblies, including both scheduled blank openings and openings containing penetrating items including:
 - a. Penetrations in floor-ceiling assemblies.
 - b. Penetrations in roof-ceiling assemblies.
 - c. Penetrations in walls and partitions.
 - d. Penetrations in smoke barriers.
 - e. Expansion joints.
 - f. Construction enclosing compartmentalized areas.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and 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.
- C. Refer to Penetration Firestopping Systems included on the Drawings and Specifications for anticipated systems. Contractor shall prepare and submit other systems as required to meet specific field conditions.**

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.
- B. Product Test Reports:** For each penetration firestopping system, for tests performed by a qualified testing agency.

- C. Submit complete project specific submittal package for approval *prior to start of work*. Submittal package to include the following:
1. Project specific list (Schedule) of each UL system to be installed, whether shown in drawings and specifications or not. General Contractor is responsible for firestopping systems required by actual conditions in the field, as part of means, methods, and techniques.
 - a. UL System number
 - b. Types of penetrating items.
 - c. Types of construction penetrated, and where applicable, thicknesses of construction penetrated.
 - d. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 2. Shop Drawings: For each through-penetration firestop system, submit copies of all UL system drawings.
 - a. UL systems shall be broken out by trade:
 - 1) Plumbing
 - 2) Mechanical Piping
 - 3) Sheet Metal Ductwork
 - 4) Fire Suppression
 - 5) Electrical and Low Voltage
 3. Engineering Judgements: Where project conditions require modification to a UL listed system or a qualified testing and inspection agency's illustration for a particular through-penetration firestop condition, submit illustration with modifications marked, approved by through-penetration firestop system manufacturer's fire protection engineer as and engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

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 Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Specified Technologies, Inc.
- 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. Manufactured Piping Penetration Firestopping System: 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProVent Systems, Inc.
 - b. RectorSeal Firestop; a CSW Industrials Company.
 2. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 3. 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.
 4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 5. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 6. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 7. Special Coating: Corrosion resistant on interior of fittings.
- G. 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.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. 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.
- C. 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.

3.4 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.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide" under "Wall and Floor Penetration Fire Stops."
- D. Refer to Penetration Firestopping Systems included on the Drawings and Specifications for anticipated systems. Contractor shall prepare and submit other systems as required to meet specific field conditions.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intumescent gypsum wall framing gaskets.
2. Perimeter fire-barrier system.
3. Joints in or between fire-resistance-rated construction.
4. Joints at exterior curtain-wall/floor intersections.
5. Joints in smoke barriers.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

- B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestop manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestop systems in EJs.

- C. 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 EJ or equivalent fire-resistance-rated assembly developed in accordance with current IFC guidelines.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

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 installation instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems in accordance with manufacturer's written installation instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed in accordance with specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform joint firestopping system tests.
 - 2. Test in accordance with testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."
 - 2) Intertek Group in its "Directory of Building Products."
- B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEM TYPES

- A. General: 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 must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
 - 1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
 - 2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
 - 3. Provide firestop products that do not contain ethylene glycol.
- B. Intumescent Gypsum Wall Framing Gaskets: Applied to steel tracks, runners, and studs prior to framing installation. Provide products with fire, smoke, and acoustical ratings that allow movement of up to 100 percent compression and/or extension when tested in accordance with UL 2079 or ASTM E1966; have an L Rating of less than 1 cfm/ft. when tested in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 when tested in accordance with ASTM E90 or ASTM C919.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich.
 - c. International Fireproof Technology Inc.
 - d. Specified Technologies Inc.
- C. Perimeter Fire-Barrier System: Provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation for aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches. System will be tested in accordance with ASTM E2307 for up to two-hour fire resistance and with ASTM E1233/E1233M for wind cycling equivalent to 108 mph wind for 500 cycles.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. Grabber Construction Products, Inc.
 - c. Specified Technologies Inc.
- D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction.
 - b. Hilti, Inc.
 - c. Marino\WARE.

- d. ROCKWOOL.
 - e. Specified Technologies Inc.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
 - E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined in accordance with ASTM E2307.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction.
 - b. Hilti, Inc.
 - c. ROCKWOOL.
 - d. Specified Technologies Inc.
 - 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - F. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined in accordance with UL 2079 based on testing at a positive pressure differential of 0.30 inch wg.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction.
 - b. Hilti, Inc.
 - c. Marino\WARE.
 - d. Specified Technologies Inc.
 - 2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
 - G. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E84.
- 2.4 ACCESSORIES
- A. 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 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints in accordance with fire-resistive joint system manufacturer's written installation instructions and the following requirements:
 - 1. Remove foreign materials from substrate surfaces that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates in accordance with joint firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Apply a suitable bond breaker to prevent three-sided adhesion in applications where condition occurs.

3.3 INSTALLATION

- A. General: Install joint firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Apply elastomeric fill in voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing 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 ft. from end of wall and at intervals not exceeding 30 ft..
- B. 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 joint firestopping system. Use mechanical fasteners or self-

adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with 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.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urethane joint sealants.
2. Mildew-resistant joint sealants.
3. Butyl joint sealants.
4. Latex joint sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for fire rated joint seals.
2. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
3. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
4. Refer to Civil Drawings for "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.
5. Refer to Pool Drawings for "Pool and Deck area Joint Sealants" for sealing joints in swimming pool and adjacent paved deck areas.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Joint-sealants.
2. Joint sealant backing materials.

- B. Samples:** Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

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. Test and Evaluation Reports:

1. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

- a. Joint-sealant location and designation.
 - b. Manufacturer and product name.
 - c. Type of substrate material.
 - d. Proposed test.
 - e. Number of samples required.
 2. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
 3. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- B. Field Quality-Control Submittals:
1. Field-Adhesion-Test Reports: For each sealant application tested.
- C. Sample warranties.
- 1.5 CLOSEOUT SUBMITTALS
- A. Warranty Documentation:
1. Manufacturers' special warranties.
 2. Installer's special warranties.
- 1.6 QUALITY ASSURANCE
- A. Qualifications:
1. Installers: Authorized representative who is trained and approved by manufacturer.
 2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.
- 1.7 MOCKUPS
- A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants in accordance with 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) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.9 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Exterior Work that does not remain weathertight and all Work which does not retain all properties inherent in the product will be considered faulty.
- D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 URETHANE JOINT SEALANTS

- A. 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.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol II.
 - b. Master Builders Solutions; Master Seal NP II.
 - c. Tremco Incorporated; Dymeric.
- B. 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.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Builders Solutions; MasterSeal SL 2 (Pre-2014: Sonolastic SL2).
 - b. Pecora Corporation; Urexpan NR 200.
 - c. Tremco Incorporated; THC 901.

2.4 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.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS 1700.
 - b. Pecora Corporation; Pecora 860.
 - c. The Dow Chemical Company; Dowsil 786.
 - d. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bostik; Arkema.
 - b. Everkem Diversified Products, Inc.
 - c. GSSI Sealants.
 - d. Pecora Corporation.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20.
 - b. Tremco Incorporated; Tremflex 834.
 - c. Master Builders Solutions; NP 520.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adfast.
 - b. Alcot Plastics Ltd.
 - c. Construction Foam Products; a division of Nomaco, Inc.
 - d. Master Builders Solutions.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or any other types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.

- d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.
 - b. Test Method: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
 - 2. 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.
- C. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 1. Joint Locations including but not limited to the following locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between fiber-cement siding.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in adhered stone masonry veneer.
 - e. Joints in exterior insulation and finish systems.
 - f. Joints between metal panels.
 - g. Joints where dissimilar materials meet.
 - h. Perimeter joints between materials and frames of doors, windows, and louvers.
 - i. Control and expansion joints in ceilings and other overhead surfaces.
 - j. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Interior joints in horizontal traffic surfaces:
 - 1. Joint Locations including but not limited to the following 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. Joints where dissimilar materials meet.
 - f. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:
 - 1. Joint Locations including but not limited to the following 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. Joints where dissimilar materials meet.
 - d. 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.
- D. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:
- 1. Joint Locations including but not limited to the following locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, shower stalls, countertops, 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.
- E. Concealed mastics:
- 1. Joint Locations including but not limited to the following locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Butyl-rubber based.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical joint sealants.

B. Samples: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

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. Test and Evaluation Reports:

1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.5 WARRANTY

A. Installer's Special 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. Manufacturer's Special 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 ACOUSTICAL JOINT SEALANTS

- A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grabber Construction Products; GrabberGard EGC Fire Caulk.
 - b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
 - c. OSI Sealants; Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - d. Pecora Corporation; AC-20.
 - e. Specified Technologies, Inc.; SpecSeal SIL Silicone Firestop Sealant.
 - f. Tremco Incorporated; TREMstop Acrylic.
 - g. USG Corporation; SHEETROCK Firecode Smoke-Sound Sealant.
 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such

protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.

9. Details of moldings, removable stops, and glazing.

- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
- B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.
- D. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, section 5.2.3.1.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door; AADG, Inc.; ASSA ABLOY.

2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. LaForce, LLC.
4. MPI Group, LLC (The).
5. Mesker Door; Mesker Openings Group.
6. Premier Products, Inc.
7. Republic Doors and Frames; an Allegion brand.
8. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 1. 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 in accordance with UL 1784 and installed in compliance with NFPA 105.
 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C.
 1. Doors:
 - a. Type: Typical metal doors shall be Steelcraft CE20 Series Level 1, Model 2, HD2 panel doors as indicated on the drawings. Doors shall be (1-3/4", 24-gauge steel) for interior doors. The doors shall be fabricated of cold rolled steel with honeycomb core unless sound deadening is required, then insulation of the highest R value available for interior doors or polystyrene insulation. Doors to wet areas shall be of galvanized construction, with galvanized inverted top caps sealed in place. Doors shall be mortised and reinforced for all hardware, shall be internally reinforced for all surface closers, hinge and lock locations and shall be Bonderized and finished with one coat of baked on prime coat of rust resistant paint.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.032 inch
 - d. Edge Construction: Model 2, Seamless.

- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Manufacturer's standard.
 - g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
2. Frames:
- a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: 3-piece KD drywall frames equal to Steelcraft DW-16, (16 gage steel).
3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:
- a. Type: Typical metal doors shall be equal to Steelcraft CE20 Series Level 1, Model 2, HD2 panel doors as indicated on the drawings. The doors shall be fabricated of cold rolled steel and shall be insulated with the highest R-value available. Doors to the exterior shall be of min G60 galvanized construction, steel with insulation of the highest R value available, with galvanized inverted top caps sealed in place. Doors shall be mortised and reinforced for all hardware, shall be internally reinforced for all surface closers, hinges and locksets, and shall be Bonderized and finished with one coat of baked on prime coat of rust resistant paint.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's standard.
 - i. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
2. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
3. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.042 inch.
- B. Construction: Match frame
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.8 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.9 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 LOUVERS

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 4. Solidly pack mineral-fiber insulation inside frames.
 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
- 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 assembly 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.

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 082000 - PEDESTRIAN DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all Pedestrian Doors, complete in place, as shown on the Drawings and as specified herein.

1.2 SUBMITTALS

- A. The Contractor shall prepare, and submit to the Architect for approval, electronic copies of complete shop drawings for all work included in this Section and shall not proceed with fabrication and delivery prior to receiving such approval. Show anchors, hardware operators and other components not included in manufacturer's standard data. Include glazing details as well as manufacturer's product data.

1.3 PROTECTION

- A. Doors shall be handled with care to prevent damage. The Contractor shall examine all doors prior to installation and repair or replace damaged doors as required.

PART 2 - PRODUCTS

2.1 DOORS

- A. Apartment Unit entry doors, and common area Tenant Storage, IT Room, HVAC Closet, and Attic Access doors shall be of sizes indicated on the drawings. Door units shall be pre-hung, Jeld-Wen Birkdale 3 panel, smooth, 1-3/4" thick, solid core, molded doors, or approved equal. Door frames shall be manufacturer's standard fire rate frames with EC356 2-1/4" primed wood casing. Hinges shall be (3) 4" x 4" satin nickel hinges. Door units shall be machined for locksets specified in Division 08, Section "Door Hardware" and carry a minimum 20-minute fire-resistive rating as tested under NFPA 252 or UL 10C.
- B. Raised panel doors within the Apartment Units shall be of sizes indicated on the drawings. Door units shall be pre-hung, Jeld-Wen Birkdale 3 panel, smooth, 1-3/8" thick, hollow core, molded doors or approved equal. Door frames shall be manufacturer's standard finger-jointed pine frames with EC356 2-1/4" finger-jointed primed pine casing. Hinges shall be (3) 3-1/2" x 3-1/2" satin nickel hinges. Doors shall be machined for locksets specified in Division 08, Section "Door Hardware".
- C. Swinging patio doors at the Apartment Units shall be of sizes indicated on the drawings. Door units shall be 1-3/4" thick pre-hung JeldWen Design-Pro Fiberglass Full Lite Doors, or approved equal, with polyurethane core, 1-inch Low-E tempered insulating glass, hinge reinforcement, reinforced lockset preparation, painted spring hinges and triple contact extruded vinyl bottom sweep. Doors shall have maximum U-Factor and SHGC of 0.28. Door frames shall be composite wood frames with type TPE magnetic perimeter weatherstripping and threshold shall comply with the USDOJ's "2010 ADA Standards for Accessible Design," set in a full bed of caulking.

- D. Exterior Building Stair entry doors shall be of sizes indicated on the drawings. Door units shall be 1-3/4" thick pre-hung Therma-Tru Traditions, Half Lite 2 Panel insulated steel door. Doors shall have a maximum U-factor and SHGC of 0.29. Door frames shall be composite wood frames with type TPE magnetic perimeter weatherstripping and threshold designed for use by physically handicapped persons set in a full bed of caulking.
- E. All steel doors shall carry the manufacturer's standard 20 year warranty.
- F. All steel doors shall be supplied prime painted and shall be painted within 30 days of installation. Failure to paint the doors within 30 days may void the warranty.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. All doors and their frames shall be set true, plumb, level and in strict accordance with the manufacturer's directions. Provide a solid shim between the door frame and the stud framing behind the strike plate of all exterior entry doors.
- B. Door thresholds shall be covered and protected from construction traffic until final cleaning of finished units.
- C. Comply with manufacturer's specifications and recommendations for installation of door units, hardware, operators, and other components of work.
- D. Protect metal in contact with masonry, steel, concrete or other dissimilar material from contact by neoprene gaskets or bituminous coating.
- E. Adjust opening hardware to provide tight fit at contact joints and at weatherstripping, and to ensure smooth operation and weather tight closure.
- F. Door jambs may be finger-jointed and factory primed at the Contractor's option.

END OF SECTION 082000

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
 - a. Flush access door and trimless frames in public areas
 - b. Surface mounted economy access door and frame in utility or back of house areas.
2. Fire-rated access doors and frames.
 - a. Flush access door and trimless frames in public areas
 - b. Surface mounted economy access door and frame in utility or back of house areas.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

D. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test response characteristics according to the following test method and that are listed and labeled by UL or another qualified testing and inspection agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire rated access door assemblies installed vertically
 - 2. NFPA 288 for fire rated access door installed horizontally
- B. For “Attic Draft Stop” doors: 20-inch x 30-inch minimum access doors with closer and latch, with operation from both sides, in compliance with IBC 2018, Section 718.4.1.1.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILING

- A. Basis of Design Product: subject to compliance with the requirements, provide product indicated or a comparable product by one of the following:
 - 1. Activar Construction Products Group, Inc. - JL Industries.
 - 2. ACUDOR Products, Inc.
 - 3. Milcor; a division of Hart & Cooley, Inc.
 - 4. Nystrom.
 - 5. Williams Bros. Corporation of America (The).
- B. Source Limitations: Obtain each type access door and frame from single sources from a single manufacturer.
- C. Recessed Access Doors with Concealed Flanges (Provide and install for access doors exposed to public view in non-rated construction):
 - 1. Basis of Design Product: Karp Associates, Inc. Model RDWPD.
 - 2. Assembly Description: Fabricate door in the form of a pan recessed 1/2-inch for gypsum board infill. Provide frame with gypsum board bead for concealed flange installation. Fabricate door to fit flush with frame.
 - 3. Locations: Wall and ceiling.
 - 4. Door size: minimum size required for access. Access doors adjacent to one another shall be the same size.
 - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 - 6. Frame Material: Same material and thickness as door.
 - 7. Hinges: Spring loaded concealed pin type.
 - 8. Latch and Lock: Cam latch, screwdriver operated.
- D. Fire Rated, recessed Access Doors with Concealed Flanges (Provide and install for access doors exposed to public view in fire resistive rated construction):

1. Basis of Design Product: Karp Associates, Inc. Model KRP-450FR
 2. Assembly Description: Fabricate door in the form of a pan recessed 1/2-inch for gypsum board infill. Provide frame with gypsum board bead for concealed flange installation. Fabricate door to fit flush with frame.
 3. Locations: Walls only.
 4. Fire Resistance rating: Not less than that of adjacent construction.
 5. Temperature Rise Rating: 450 deg F at the end of 30 minutes.
 6. Door size: minimum size required for access. Access doors adjacent to one another shall be the same size.
 7. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 8. Frame Material: Same material and thickness as door.
 9. Hinges: Spring loaded concealed pin type.
 10. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.
- E. Flush Access Doors with Exposed Flanges (Provide and install for access doors not exposed to public view in non-rated construction)
1. Basis of Design Product: Karp Associates, Inc. Model ME
 2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard width exposed flange, proportional to door size.
 3. Locations: Wall and ceiling.
 4. Door size: minimum size required for access. Access doors adjacent to one another shall be the same size.
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 6. Frame Material: Same material and thickness as door.
 7. Hinges: Spring loaded concealed pin type.
 8. Latch and Lock: Cam latch, screwdriver operated.
- F. Fire Rated, Flush Access Doors with Exposed Flanges (Provide and install for access doors not exposed to public view in fire resistive rated construction):
1. Basis of Design Product: Karp Associates, Inc. Model KRP-450FR for walls, KRP-150FR for ceilings.
 2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard width exposed flange, proportional to door size.
 3. Locations: Wall and ceiling.
 4. Fire Resistance rating: Not less than that of adjacent construction.
 5. Temperature Rise Rating: 450 deg F at the end of 30 minutes.
 6. Door size: minimum size required for access. Access doors adjacent to one another shall be the same size.
 7. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 8. Frame Material: Same material and thickness as door.
 9. Hinges: Spring loaded concealed pin type
 10. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Frame Anchors: Same material as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panels as required to prevent buckling.
- E. Latch and Lock Mechanism: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. Keys: Furnish two keys per lock and key all locks alike.
 - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets in holes cut through finish.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- 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 assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sectional-door assemblies.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" and ICC A117.1 applicable to sectional doors.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Testing: In accordance with ASTM E330/E330M or DASHA 108 for garage doors and complying with DASHA 108 acceptance criteria.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

- a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
- 4. Operability under Wind Load: Design sectional doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.
- C. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Model 1600 Long Panel or a comparable product by one of the following:
 - a. C.H.I. Overhead Doors, Inc.
 - b. Clopay Building Products.
 - c. Raynor Garage Doors.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.
- D. R-Value: Minimum 9.0 deg F x h x sq. ft./Btu.
- E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
 - 1. Door-Section Thickness: 2 inches.
 - 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Surface: Manufacturer's standard, paneled.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

- 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of dimension recommended in writing by manufacturer to comply with performance requirements.
3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.040-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of weatherseal.
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
6. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
 - a. Board Insulation: Polystyrene or polyurethane, secured to exterior face sheet.
 - b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- F. Track: Manufacturer's standard, galvanized-steel, standard-lift and low-headroom where required, track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide angle or brackets attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door.
- H. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

- a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.
2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Manufacturer's standard.
3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

I. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

J. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
4. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
5. Operator Type: Chamberlain RJ070, side mounted, with battery backup and remote light.

6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - b. Electrical Characteristics:
 - 1) Phase: Single phase.
 - 2) Volts: 115 V.
 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 9. Control Station: Surface mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button interior and key exterior.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - c. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 enclosure.
 - d. Features: Provide the following:
 - 1) Vehicle detection operation.
 - 2) Radio-control operation. Provide two portable control devices per door.
 - 3) Photocell operation.
 - 4) Audible and visual signals that comply with regulatory requirements for accessibility.
 10. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.
 11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

- a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.
 - 2. Aluminum-framed entrance door systems.

1.2 GLAZING

- A. Refer to Part 2 of this section for glazing all aluminum entrance and window units included herein.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. The Contractor shall prepare and submit to the Architect, for approval, of complete shop drawings for all work included in this Section, and shall not proceed with fabrication and delivery prior to receiving such approval.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 4. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

- D. Samples: For each type of exposed finish required, in manufacturer's standard sizes. Submit two 12-inch-long samples of each specified material. Include any finishes specified herein showing maximum color variation. Resubmit any color variation samples until Architect's approval. Provide any additional samples required by Contractor. Submit any special finish samples before treating quantities of metal for the work.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Test and Evaluation Reports:
 - 1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Source Quality-Control Submittals:
 - 1. Source quality-control reports.
- D. Field Quality-Control Submittals:
 - 1. Field quality-control reports.
- E. Qualification Statements:
 - 1. For Installer.
 - 2. For egress door inspector.
 - a. Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
- F. Delegated design engineer qualifications.
- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.7 MEASUREMENTS

- A. Verify all dimensions by taking field measurements. Proper fit and attachment of all component parts is required.

1.8 RESPONSIBILITY

- A. Assume sole responsibility for final construction, erection and weathertightness of the complete framing system, including all component parts and connections.

1.9 COORDINATION

- A. Coordinate work and scheduling of the work of this Section with other trades for coordination of size of reveals, locations of anchorage, etc.

1.10 INSPECTION

- A. Examine all sub-surfaces to receive work and report in writing to General Contractor, with a copy to Architect, any conditions that may be detrimental to work. Failure to observe this injunction constitutes a waiver to any subsequent claims to the contrary and will make this Contractor responsible for any corrections the Architect may require. Commencement of work will be construed as acceptance of all sub-surfaces.

1.11 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program.
 - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
 - 3. Testing Agency: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
 - 4. Egress Door Inspector: Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:

- a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
 - 2. Deflection Parallel to Glazing Plane: Amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Limited to $2L/175$ at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
- G. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.
- H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.28 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

- b. Entrance Doors: U-factor of not more than 0.28 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.27 as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.27 as determined in accordance with NFRC 200.
 - 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa) when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.

2.3 STOREFRONT SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko Window Systems, Inc.; 2450FS Series or a comparable product by one of the following:
 - 1. EFCO Corporation.
 - 2. Kawneer Company, Inc.; Arconic Corporation.
 - 3. Trulite Glass & Aluminum Solutions, LLC.
 - 4. Tubelite Inc.
 - 5. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Interior Vestibule Framing Construction: Nonthermal.
 - 3. Glazing System: Retained mechanically with gaskets on four sides.
 - 4. Glazing Plane: Front.
 - 5. Finish: High-performance organic finish.
 - 6. Fabrication Method: Field-fabricated stick system.
 - 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

8. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Insulated Spandrel Panels:
 1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - a. Overall Panel Thickness: 1 inch.
 - b. Exterior Skin: Aluminum.
 - 1) Thickness: Manufacturer's standard for finish and texture indicated.
 - 2) Finish: Match framing system.
 - 3) Texture: Smooth.
 - 4) Backing Sheet: 0.125-inch-thick, corrugated, high-density polyethylene.
 - c. Interior Skin: Aluminum.
 - 1) Thickness: Manufacturer's standard for finish and texture indicated.
 - 2) Finish: Matching storefront framing.
 - 3) Texture: Smooth.
 - 4) Backing Sheet: 0.125-inch-thick, corrugated, high-density polyethylene.
 - d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
 - e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.

2.4 ENTRANCE DOOR SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko Window Systems, Inc.; 135i Series or a comparable product by one of the following:
 1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Tubelite Inc.
 4. U.S. Aluminum; a brand of C.R. Laurence.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

- a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
- 2. Door Design:
 - a. Medium stile; 3-1/2-inch nominal width.
 - b. Doors shall have 10-inch-high bottom rail to comply with ICC/ANSI A117.1.
- 3. Glazing:
 - a. Exterior Doors: 1-inch tempered insulating glass.
 - b. Interior Doors: 1/4-inch tempered glass.
- 4. Glazing Stops and Gaskets: Beveled or square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- 5. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or products complying with BHMA standard referenced if not specifically named.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous-Gear Hinges: BHMA A156.26.

- E. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
- F. Cylinders:
 - 1. As specified in Section 087100 "Door Hardware."
- G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- H. Operating Trim: BHMA A156.6.
- I. Removable Mullions: BHMA A156.3 extruded aluminum.
 - 1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.
- J. Closers: LCN 4041 surface mounted.
- K. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- L. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- M. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- N. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch, set in full bed of sealant.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing: All glazing installed in exterior Aluminum Storefront Windows and Entrance Doors shall be 1-inch-thick clear LoE, consisting of 2 layers of 1/4-inch glass with 1/2-inch sealed Argon filled air space between, for exterior glazing and tempered where required by code. For interior glazing sidelights, etc., 1/4-inch clear glazing, tempered where required by code. All exterior glazing shall include a low emissivity coating on the second surface. All insulated glazing lites shall be guaranteed airtight and fog free for a ten-year period of time commencing with substantial completion of the building. Provide fully tempered safety glazing at locations required by the International Building Code.
 - 1. Glass Type: Vitro Solarban 70 (2) + Clear.
 - a. Visible Light Transmittance: 64 percent minimum.
 - b. Winter Nighttime U-Factor: .28 maximum.

- c. Summer Daytime U-Factor: .26 maximum.
 - d. Solar Heat Gain Coefficient: .27 maximum.
 - e. Provide safety glazing labeling for locations requiring safety glazing.
- 2. All glazing must be approved by the Owner.
- C. Insulating spandrel glass shall match insulating vision glass as approved by the Architect
- D. Glazing Gaskets: Extruded vinyl or neoprene synthetic rubber, bulb-type, continuous, standard with manufacturer of aluminum frames, black in color.
- E. Weatherstripping for exterior doors, shall be compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.
- F. Glazing Beads and Tape shall be Neoprene and butyl, respectively.
- G. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

2.7 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.8 ACCESSORIES

- A. Automatic Door Operators: Section 084229.33 "Swinging Automatic Entrances."
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

- C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- F. Rigid PVC filler.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.
- K. All glass framing shall be set in correct locations as shown in the details and shall be level, square, plumb and in alignment with other work in accordance with the manufacturer's installation instructions and approved shop drawings. All joints between framing and the building structure shall be sealed in order to secure a watertight installation.

- L. Install all work specified herein (including hardware for doors) under direct supervision of manufacturer's representatives; use mechanics skilled in this type of work. Erect any required supporting steel work per requirements of applicable Sections of Division 5.
- M. Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.
- N. Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and random site visits for inspection of product installation in accordance with manufacturer's instruction.

3.3 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

- A. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.7 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 - 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration at the interior side of the assembly. Test area shall include the test assembly and joints between the assembly and the adjacent construction.
 - 4. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
 - 1. 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 entrance door hardware.

END OF SECTION 084113

SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes vinyl-framed windows.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review, discuss, and coordinate the interrelationship of vinyl windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.
- B. Shop Drawings: For vinyl windows.
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
- D. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of vinyl window, for tests performed by a qualified testing agency.
- C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain vinyl windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: R.
 - 2. Minimum Performance Grade: 35.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.
- E. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

2.3 VINYL WINDOWS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Ply-Gem; 1500 Series or a comparable product by one of the following:
1. JELD-WEN, Inc.
 2. MI Windows and Doors, LLC.
 3. Milgard Manufacturing, LLC.
 4. Pella Corporation.
 5. Quaker Windows Products Co.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Single hung.
 2. Fixed.
- C. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Exterior Finish: Bronze.
 2. Interior Finish: Integral color, white.
 3. Gypsum Board Returns: Provide at interior face of frame.
- D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
1. Kind: Fully tempered where indicated on Drawings and as required by safety glazing locations.
- E. Insulating-Glass Units: ASTM E2190.
1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - b. Kind: Fully tempered where indicated on Drawings and as required by safety glazing locations.
 2. Lites: Two.
 3. Filling: Fill space between glass lites with argon.
 4. Low-E Coating: Pyrolytic or sputtered on second surface.
- F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- G. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- H. Hung Window Hardware:
1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.

2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks.
 3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
 4. Limit Devices: Limit window opening to 4 inches when sash is opened. Device may be disengaged, allowing window to open fully for cleaning or egress and automatically re-engages when the sash is fully closed again.
- I. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
 - J. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

- A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
 1. Quantity and Type: One permanently located between insulating-glass lites.
 2. Material: Manufacturer's standard.
 3. Pattern: As indicated on Drawings.
 4. Profile: As selected by Architect from manufacturer's full range.
 5. Color: As selected by Architect from manufacturer's full range.

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 1. Type and Location: Half, outside for single-hung sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
 2. Finish for Interior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range.
 3. Finish for Exterior Screens: Matching color and finish of cladding.
- C. Glass-Fiber Mesh Fabric: Mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.
 1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

- A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.

- B. Glaze vinyl windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units. Provide manufacturer's standard finish to match window units.
- E. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
 - 2. Air-Infiltration Testing:

- a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under "Performance Requirements" Article, but not less than 4.16 lbf/sq. ft., and shall not show evidence of water at the interior side of the assembly. Test area shall include the test assembly and joints between the assembly and the adjacent construction.
 - 5. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
 - 6. Test Reports: Prepared according to AAMA 502.
 - C. Windows will be considered defective if they do not pass tests and inspections.
 - D. Prepare test and inspection reports.
- 3.4 ADJUSTING, CLEANING, AND PROTECTION
- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
 - B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
 - C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
 - D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085313

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies.
2. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
3. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.

1.2 COORDINATION

- A. Installation Templates:** Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security:** Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In:** Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.
- B. Keying Conference:** Conduct conference at Project site.
1. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For electrified door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
 - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- D. Door Hardware Schedule: Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.
- E. Keying Schedule: Detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
 - 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Design Hardware; Mesker Openings Group; dormakaba.
 - c. Hager Companies.
 - d. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - e. PAMEX Inc.
 - f. PBB, Inc.
 - g. STANLEY; dormakaba USA, Inc.

B. Antifriction-Bearing Hinges:

1. Bearing Material: Ball bearing.
2. Grade 1 (heavy weight).
3. Base and Pin Material:
 - a. Exterior Hinges: Stainless steel with stainless steel pin.
 - b. Interior Hinges: Stainless steel with stainless steel pin.
 - c. Hinges for Fire-Rated Assemblies: Stainless steel with stainless steel pin.
4. Pins: Non-rising loose unless otherwise indicated.
 - a. Outswinging Exterior Doors: Nonremovable.
 - b. Outswinging Corridor Doors with Locks: Nonremovable.

2.4 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: BHMA A156.17.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Design Hardware; Mesker Openings Group; dormakaba.
 - c. Hager Companies.
 - d. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - e. Pamex, Inc.
 - f. PBB, Inc.
 - g. STANLEY; dormakaba USA, Inc.

B. Spring Hinges: Grade 1; wrought steel, with torsion spring.

2.5 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - d. PBB, Inc.
 - e. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - f. STANLEY; dormakaba USA, Inc.
2. Hinges for Fire-Rated Assemblies: With steel fire pins to hold fire-rated doors in place if required by tested listing.

2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 3. Deadbolts: Minimum 1-inch bolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.
- D. Lock Trim:
 1. Levers: Cast.
 2. Escutcheons (Roses): Cast.
 3. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 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: Manufacturer's special strike box fabricated for aluminum framing.
 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Arrow USA; an ASSA ABLOY Group company.
 - c. BEST Access Solutions, Inc.; dormakaba USA Inc.
 - d. Corbin Russwin, Inc.; an ASSA ABLOY Group company.

- e. Design Hardware; Mesker Openings Group; dormakaba.
 - f. Hager Companies.
 - g. PAMEX Inc.
 - h. SARGENT Manufacturing Company; ASSA ABLOY.
 - i. STANLEY; dormakaba USA, Inc.
 - j. Yale Security Inc; ASSA ABLOY.
- G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Company, an ASSA ABLOY Group company.
 - b. Allegion plc.
 - c. Arrow USA; an ASSA ABLOY Group company.
 - d. BEST Access Solutions, Inc.; dormakaba USA Inc.
 - e. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - f. Design Hardware; Mesker Openings Group; dormakaba.
 - g. Hager Companies.
 - h. SARGENT Manufacturing Company; ASSA ABLOY.
 - i. STANLEY; dormakaba USA, Inc.
 - j. Yale Security Inc; ASSA ABLOY.

2.7 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.36: Grade 1; with strike that suits frame.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Arrow USA; an ASSA ABLOY Group company.
 - c. BEST Access Solutions, Inc.; dormakaba USA Inc.
 - d. Hager Companies.
 - e. Medeco Security Locks; an ASSA ABLOY Group company.
 - f. SARGENT Manufacturing Company; ASSA ABLOY.
 - g. STANLEY; dormakaba USA, Inc.
 - h. Yale Security Inc; ASSA ABLOY.
 - 2. Deadlocks: Deadbolt operated by key outside and turn inside.

2.8 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
 - b. Adams Rite Manufacturing Company, an ASSA ABLOY Group company.

- c. Allegion plc.
- d. Hager Companies.
- e. Hanchett Entry Systems (HES), Inc.; ASSA ABLOY Group.
- f. STANLEY; dormakaba USA, Inc.

2.9 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
 - b. Allegion plc.
 - c. Hager Companies.
 - d. Security Door Controls.
- 2. Residual Magnetism: Not more than 4 lbf to separate door from magnet.

2.10 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. BEST Access Solutions, Inc.; dormakaba USA Inc.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.
 - d. STANLEY; dormakaba USA, Inc.
 - e. Yale Security Inc; ASSA ABLOY.

2.11 SELF-CONTAINED ELECTRONIC LOCKS

- A. Self-Contained Electronic Locks: BHMA A156.25, bored or mortise; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. BEST Access Solutions, Inc.; dormakaba USA Inc.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.
 - d. Yale Security Inc; ASSA ABLOY.

2.12 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Company, an ASSA ABLOY Group company.
 - b. Allegion plc.

2.13 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Self-Latching Flush Bolts: BHMA A156.3, Type 27; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge. Include wear plates.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Don-Jo Mfg., Inc.
 - c. Door Controls International.
 - d. Rutherford Controls Int'l. (RCI); dormakaba Group.

2.14 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Company, an ASSA ABLOY Group company.
 - b. Allegion plc.
 - c. Arrow USA; an ASSA ABLOY Group company.
 - d. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - e. Design Hardware; Mesker Openings Group; dormakaba.
 - f. Detex Corporation.
 - g. Hager Companies.
 - h. PAMEX Inc.
 - i. Precision Hardware, Inc.; dormakaba Group.
 - j. SARGENT Manufacturing Company; ASSA ABLOY.
 - k. STANLEY; dormakaba USA, Inc.
 - l. Yale Security Inc; ASSA ABLOY.
- B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
- C. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing in accordance with UL 305 and NFPA 252.

2.15 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. PAMEX Inc.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.
 - e. Stanley Commercial Hardware; a division of Stanley Security Solutions.
 - f. Yale Security Inc; an ASSA ABLOY Group company.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

2.16 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Master Key System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.
 - 2. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master and grand master keys.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.

2.17 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Key Boxes and Cabinets.
 - b. HPC, a Hudson Lock Company.
 - c. Interlogix; Carrier Global Corporation.
 - d. Lund Equipment Co., Inc.
 - e. MMF Industries.
 - f. TelKee; Oasis International.

2. Multiple-Drawer Cabinet: Grade 1 cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
3. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

B. Key Lock Boxes: Designed for storage of 10 keys.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Knox Company; 3200 Recessed.

2.18 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - d. Trimco.

B. Flat Push Plates: With square corners and beveled edges; secured with exposed screws.

1. Thickness: 1/8 inch.
2. Size: 4 inches wide by 16 inches high.

C. Push-Pull Plates: With square corners, beveled edges, and raised integral lip; secured with exposed screws.

1. Thickness: 1/8 inch.
2. Size: 3-1/2 inches wide by 15-3/4 inches high.

D. Offset Door Pulls: 1-inch (25-mm) constant-diameter pull.

1. Mounting: Surface applied with concealed fasteners.
2. Offset: 2 inches.
3. Minimum Clearance: 2-1/4 inches from face of door.
4. Overall Length: 9 inches.

E. Offset Push-Pull Door Pulls: Pull fixed to 0.050-inch- thick plate, 4 inches wide by 16 inches high with square corners and beveled edges.

1. Pull Diameter: 1-inch constant diameter.
2. Pull Offset: 2 inches.
3. Minimum Pull Clearance: 2-1/4 inches from face of door.
4. Overall Pull Length: 9 inches.

2.19 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever, and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.20 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. LCN; Allegion plc.
 - b. Norton Door Controls; an ASSA ABLOY Group company.
 - c. PAMEX Inc.
 - d. American Eagle; PDQ Manufacturing.
- B. Surface Closer with Cover: Grade 1; Modern type with mechanism enclosed in cover.
 - 1. Mounting: Parallel arm.
 - 2. Type: Regular arm or hold open.
 - 3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
 - 4. Cover Material: Aluminum.
 - 5. Closing Power Adjustment: At least 35 percent more than minimum tested value.

2.21 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ives; Allegion plc.
 - b. Cal-Royal Products, Inc.
 - c. PAMEX Inc.
 - 2. Wall Bumpers: Grade 1; with rubber bumper; 2-1/2-inch diameter, minimum 3/4-inch projection from wall; with backplate for concealed fastener installation.

2.22 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire-alarm system for labeled fire-rated door assemblies.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.

2.23 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko; an ASSA ABLOY Group Company.
 - c. Reese Enterprises, Inc.
- B. Maximum Air Leakage: When tested in accordance with ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:
1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
 2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
 3. Gasketing on Double Doors: 0.50 cfm per ft. of door opening.
- C. Adhesive-Backed Perimeter Gasketing: Silicone gasket material applied to frame rabbet with self-adhesive.
- D. Door Sweeps: Neoprene gasket material held in place by flat housing or flange; surface mounted to face of door with screws.
1. Housing or Flange Material: Aluminum.

2.24 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
 - d. Reese Enterprises, Inc.
 - e. Rixson Specialty Door Controls; ASSA ABLOY.
 - f. Zero International; Allegion plc.

- B. Saddle Thresholds:
 - 1. Type: Thermal break and fluted top.
 - 2. Base Metal: Aluminum.

2.25 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Hager Companies.
 - c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
- B. Kick Plates: 10 inches high by door width with allowance for frame stops.
- C. Mop Plates: 6 inches high by 1 inch less than door width.

2.26 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Cal-Royal Products, Inc.
 - c. Hager Companies.
 - d. Pamex, Inc.
 - e. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
- B. Coat Hooks: Grade 1; two curved hooks with rounded ends; 3-inch projection from wall; for surface-screw application.
 - 1. Material: Burnished cast aluminum.
- C. Wide-Angle Door Viewers: Grade 1; solid brass with optical glass lenses; adjustable to door thickness and permitting one-way observation with minimum 180-degree viewing angle.
- D. Fire-Rated Door Viewers: Solid brass with optical glass lenses; listed and labeled for use in fire-rated assemblies; adjustable to door thickness, and permitting one-way observation with minimum 180-degree viewing angle.
- E. Silencers for Wood Door Frames: Grade 1; neoprene or rubber; minimum 5/8 by 3/4 inch; fabricated for drilled-in application to frame.
- F. Silencers for Metal Door Frames: Grade 1; neoprene or rubber; minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.27 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY.
 - b. Allegion plc.
 - c. Hager Companies.
 - d. PAMEX Inc.
 - e. Precision Hardware, Inc.; dormakaba Group.
 - f. SARGENT Manufacturing Company; ASSA ABLOY.
- B. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; listed and labeled for use with fire-alarm systems.
- C. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.

2.28 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:

- 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.29 FINISHES

- A. Provide finishes complying with BHMA A156.18, US15/619 (Satin Nickel) in Units and US26D/626 (Satin Chrome) in common areas, unless otherwise indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Key Control System:
 - 1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
 - 2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
- E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
 - 1. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 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.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
 - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.7 UNIT DOOR HARDWARE SCHEDULE

Hardware Set U1: Unity Entry (20 minute)

Passage Latch	SD126 MEM
Electronic Smart Deadbolt	Kwikset Smart Lock
Door Viewer	DD01-180UL

BALANCE OF DOOR HARDWARE BY DOOR SUPPLIER (NOTE TWO HINGES SHALL BE SPRING HINGES AND SELF CLOSING)

SMOKE GASKET BY DOOR SUPPLIER

Hardware Set Type 'A' Unit Entry Doors U1; (20 minute)

Passage Latch	SD126 MEM
Electronic Smart Deadbolt	Kwikset Smart Lock
Door Viewer	DD01-180UL
Door Viewer	DD01-180UL (mounted at accessible height)

BALANCE OF DOOR HARDWARE BY DOOR SUPPLIER (NOTE TWO HINGES SHALL BE SPRING HINGES AND SELF CLOSING)

THUMB TURN DEADBOLT SHALL BE AN ADA ACCESSIBLE DEVICE ON ALL TYPE 'A' UNITS

SMOKE GASKET BY DOOR SUPPLIER

Hardware Set U2: Patio/Balcony

Entrance Lock	SD116 MEM
Single Cylinder Deadbolt	KV116
Threshold	Endura 7-9/16-inch In-Swing Sill
Hinge Pin Stops	IVHP23 – at floors above ground floor
Wall Stop	575 – at ground floors

BALANCE OF HARDWARE BY DOOR SUPPLIER

HINGES TO HAVE NON-REMOVABLE PINS AT GROUND FLOORS

Hardware Set U3: Patio/Balcony Doors

Entrance Lock	SD116 MEM
Single Cylinder Deadbolt	KV116
Threshold	Endura 7-9/16-inch In-Swing Sill
Hinge Pin Stops	IVHP23 – at floors above ground floor

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U4: Bedroom

Privacy Lock	SD176 MEM
Wall Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U5: Bathroom

Privacy Lock	SD176 MEM
Wall Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U6: HVAC

Passage Latch	SD126 MEM
Door Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U7: Laundry Pair of Doors

Dummy Trim	SD211 MEM
Ball Catch	DIB1

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U8: Laundry

Passage Latch	SD126 MEM
Door Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U9: Closet

Passage Latch	SD126 MEM
Door Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U10: Closet

Passage Latch	SD126 MEM
Door Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U11: Closet Pair of Doors

Dummy Trim	SD211 MEM
Ball Catch	DIB1

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U12: Coats

Passage Latch	SD126 MEM
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BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U13: Coats

Passage Latch	SD126 MEM
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BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U14: Coats

Passage Latch	SD126 MEM
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BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U15: Bedroom

Privacy Lock	SD176 MEM
Wall Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U16: Bathroom

Privacy Lock	SD176 MEM
Wall Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

Hardware Set U17: Closet

Passage Latch	SD126 MEM
Door Stop	Hinge Pin Stop where wall stop is not practical

BALANCE OF HARDWARE BY DOOR SUPPLIER

3.8 COMMON AREA DOOR HARDWARE SCHEDULE

Hardware Set C01: Corridor Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Passage Function	SD126 MEM
Closer	7101-DS 689

Hardware Set C02: Building Entry

Continuous Hinge	HCFM110
Entrance Lock	
Panic Device	10 Series - Rim
Closer	7101-DS 689
Weatherstripping	160VDkB
Threshold	425E
Bottom Sweep	200NSS
Access Control	Entry Security Devices by Owner. Coordinate function as required
Rain Drip Guard	NGP 16A

Hardware Set E01: Elevator Lobby Pair of Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Passage Latch	
Panic Device	60 Series - Concealed Vertical Rod
Dustproof Strike	570
Closer	7101-DS 689
Magnetic Hold-Open	Rixson 990M Series
Smoke Seals	9750

Hardware Set F01: Fire Door Pair double egress

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Passage Latch	
Panic Device	60 Series - Concealed Vertical Rod
Dustproof Strike	570
Closer	7101-DS 689
Magnetic Hold-Open	Rixson 990M Series
Smoke Seals	9750

Hardware Set G01: Garage Doors

Refer to Section 083613 Sectional Doors.

Hardware Set G02: Not Used

Hardware Set G03: Not Used

Hardware Set G04: Garage Entry Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height

Hardware Set M01: I.T. Closet Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height
Smoke Seals	9750

Hardware Set M02: Mech. Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height
Smoke Seals	9750

Hardware Set M03: Janitors Closet Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height

Hardware Set M04: Maintenance Garage Doors

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height

Hardware Set M05: Exterior Sprinkler Room

Continuous Hinge	HCFM110
Storeroom Function	SD126 MEM
Threshold	Pemko 270
Weatherstripping	160VDkB
Bottom Sweep	200NSS
Drip Cap	Pemko 346

Hardware Set S01: Exterior Stair Doors

Continuous Hinge	HCFM110
Entrance Lock	
Panic Device	10 Series - Rim
Closer	7101-DS 689
Weatherstripping	160VDkB

Threshold	425E
Bottom Sweep	200NSS
Access Control	Entry Security Devices by Owner. Coordinate function as required
Drip Cap	Pemko 346

Hardware Set S02: Stair to Corridor

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Passage Latch	SD126 MEM
Closer	7101-DS 689
Kick Plate	PDQ 98 Series - 10-inch height
Door Stop	Hinge Pin Stop where wall stop is not practical

Hardware Set T01: Tenant Storage

Ball-Bearing Hinges	BB81 4-1/2x 4-1/2
Storeroom Function	SD126 MEM
Kick Plate	PDQ 98 Series - 10-inch height
Wall Mount Door Bumper	101 Series Convex

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 057313 "Glazed Decorative Metal Railings" for glazing in railings.
2. Section 088300 "Mirrors."
3. Section 088813 "Fire-Rated Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers:** Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses:** Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC:** International Building Code.
- D. Interspace:** Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.**

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data:** For each type of product.

- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing 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 qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for 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 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. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 5. Visible Reflectance: Center-of-glazing values, in accordance with 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. NGA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. 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 the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGC Glass Company North America, Inc.
 - b. Cardinal Glass Industries.
 - c. Guardian Glass; SunGuard.
 - d. Pilkington North America.
 - e. Vitro Architectural Glass.

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.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

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.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Low-E-Coated Vision Glass: ASTM C1376.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cardinal Glass Industries.
 - b. Guardian Glass; SunGuard.
 - c. Pilkington North America.
 - d. Viracon, Inc.
 - e. Vitro Architectural Glass.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard hybrid warm edge spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

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 of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. Pecora Corporation.
 - c. Sika Corporation.
 - d. The Dow Chemical Company.
 - e. Tremco Incorporated.
2. Applications: Aluminum storefront framing and doors, interior special glazing, aluminum sliding doors, steel doors.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for

application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. 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 in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing 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 in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-1: Clear, fully tempered float glass.
 - 1. Minimum Thickness: 1/4 inch, (6 mm).
 - 2. Safety glazing required.
- B. Glass Type GL-2: Clear, heat-strengthened float glass.
 - 1. Minimum Thickness: 1/4 inch, (6 mm).

3.9 INSULATING GLASS SCHEDULE

- A. Clear Insulating Glass Type GL-3:
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Minimum Thickness of Each Glass Lite: 1/4 inch, (6 mm).
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Annealed at areas indicated, and Fully tempered float glass.
 - 6. Safety glazing required.

B. Low-E-Coated, Clear Insulating Glass Type GL-4:

1. Basis-of-Design Product: Vitro Architectural Glass; Solarban® 70 (2) + Clear.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second or third surface.
8. Winter Nighttime U-Factor: 0.28 maximum.
9. Summer Daytime U-Factor: 0.26 maximum.
10. Visible Light Transmittance: 64 percent minimum.
11. SGHC: 0.27 maximum.
12. Safety glazing required.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

B. Related Requirements:

1. Section 088000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror and mirror mastic.

C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- C. Safety Glazing Products: For mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Avalon Glass and Mirror Company.
2. Binswanger Mirror; a division of Vitro America, Inc.
3. D & W Incorporated.
4. Donisi Mirror Company.
5. Dulles Glass & Mirror.
6. Gardner Glass, Inc.
7. Gilded Mirrors, Inc.
8. Glasswerks LA, Inc.
9. Guardian Glass; SunGuard.
10. Head West.
11. Independent Mirror Industries, Inc.
12. Lenoir Mirror Company.
13. National Glass Industries.
14. Stroupe Mirror Co., Inc.
15. Sunshine Mirror.
16. Trulite Glass & Aluminum Solutions, LLC.
17. Virginia Mirror Company, Inc.
18. Walker Glass Co., Ltd.

- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.
- B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.
1. Nominal Thickness: 1/4 inch.
- C. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Aluminum J Channel Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) C.R. Laurence Co., Inc.
 - 3) Stylmark, Inc.
 - 2. Aluminum J Channel Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) C.R. Laurence Co., Inc.
 - 3) Stylmark, Inc.
 - 3. Finish: Clear bright anodized.
- B. Top and Bottom Mirror Mounting Clips: #277 mirror clips as manufactured by Knappe & Vogt or approved equal.
- C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.
- E. For special sizing, frames, trim materials, and finishes refer to Interior Design Drawings and Schedules.

2.5 FABRICATION

- A. Shop fabricate mirrors to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. NGA Publications: "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
 - 2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
 - 4. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

- D. Install wall mounted mirrors in the Apartment units with mirror clips. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
- E. Install wall mounted mirrors in Clubhouse Restrooms with Gunther Ultra/bond Mirror Mastic, or approved equal, high strength, general purpose mastic. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
- F. Install wall mounted mirrors in the Clubhouse Exercise Room with mastic and continuous top and bottom J-Channel mirror hardware. Mirrors shall be full wall height mirrors in the largest sizes possible to minimize the number of joints. No horizontal joints will be allowed. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 088300

SECTION 088813 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection-rated glazing.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and glass testing agency.
- B. Product Certificates: For each type of glass and glazing product.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: For each glass type, obtain from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate

manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
 - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.
- C. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products ; FireLite Plus®. or by one of the following:
 - a. Schott North America, Inc.; PYRAN Platinum fire-rated glass ceramic.
 - b. Vetrotech Saint-Gobain; Keralite Laminated.
- D. Fire-Protection-Rated Laminated Glass with Intumescent Interlayer: Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products ; Pilkington Pyrostop®. or a comparable product by one of the following:
 - a. Pilkington North America.

- b. Vetrotech Saint-Gobain.

2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. The Dow Chemical Company.
 - c. Tremco Incorporated.
 - 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and

installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

- D. Install gaskets so they protrude past face of glazing stops.

3.6 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. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 FIRE-PROTECTION-RATED GLAZING SCHEDULE

- A. Glass Type FPGL-1: 20-minute fire-protection-rated glazing with hose-stream test; fire-protection-rated laminated ceramic glazing.
 - 1. Basis-of-Design Product: Technical Glass Products Fire Lite Plus, Premium Grade, 20-minute fire-rated.
 - 2. Outer Ply: Clear proprietary glass.
 - 3. Inner Ply: Clear proprietary glass.
 - 4. Appearance: Clear.
 - 5. Minimum Thickness Total: 5/16 inches, (8mm).
 - 6. Interlayer Thickness: As required by manufacturer.
 - 7. Visible Light Transmittance: 85% percent minimum.
 - 8. Safety glazing required.
- B. Glass Type FPGL-2: 45-minute fire-protection-rated glazing; fire-protection-rated laminated ceramic glazing.

1. Basis-of-Design Product: Technical Glass Products Fire Lite Plus, Premium Grade, 45-minute fire-rated.
 2. Outer Ply: Clear proprietary glass.
 3. Inner Ply: Clear proprietary glass.
 4. Appearance: Clear.
 5. Minimum Thickness Total: 5/16 inches, (8mm).
 6. Interlayer Thickness: As required by manufacturer.
 7. Visible Light Transmittance: 85% percent minimum.
 8. Safety glazing required.
- C. Glass Type FPGL-3: 60-minute fire-protection-rated glazing with 450 deg F temperature-rise limitation in rated doors only, with a maximum vision area of 100 sq. in.; fire-protection-rated laminated glass with intumescent interlayers.
1. Basis-of-Design Product: Technical Glass Products Fire Lite Plus, Premium Grade, 60-minute fire-rated.
 2. Outer Ply: Clear proprietary glass.
 3. Inner Ply: Clear proprietary glass.
 4. Appearance: Clear.
 5. Minimum Thickness Total: 5/16 inches, (8mm).
 6. Interlayer Thickness: As required by manufacturer.
 7. Visible Light Transmittance: 85% percent minimum.
 8. Safety glazing required.
- D. Glass Type FPGL-4: 90-minute fire-protection-rated glazing with 450 deg F temperature-rise limitation in rated doors only, with a maximum vision area of 100 sq. in.; fire-protection-rated laminated glass with intumescent interlayers.
1. Basis-of-Design Product: Technical Glass Products Fire Lite Plus, Premium Grade, 90-minute fire-rated.
 2. Outer Ply: Clear propriety glass.
 3. Inner Ply: Clear propriety glass.
 4. Appearance: Clear.
 5. Minimum Thickness Total: 5/16 inches, (8mm).
 6. Interlayer Thickness: As required by manufacturer.
 7. Visible Light Transmittance: 85% percent minimum.
 8. Safety glazing required.

END OF SECTION 088813

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated on Drawings.
- B. STC Rating: As indicated on Drawings.

C. Gypsum Shaftliner Board:

1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Certainteed; SAINT-GOBAIN.
 - 2) National Gypsum Company.
 - 3) USG Corporation.
2. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Certainteed; SAINT-GOBAIN.
 - 2) National Gypsum Company.
 - 3) USG Corporation.
3. Moisture- and Mold-Resistant, Fiberglass-Mat Faced: ASTM C1658/C1658M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Certainteed; SAINT-GOBAIN.
 - 2) Georgia-Pacific Gypsum LLC.
 - 3) USG Corporation.

D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 unless otherwise indicated.

E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.030 inch.

F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: 0.030 inch.

G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly

indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. Fire Trak Corp.
 - c. Steel Construction Systems.
 - d. The Steel Network, Inc.
- H. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- I. Finish Panels: Gypsum board as specified in Section 092900 "Gypsum Board."
- J. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 079219 "Acoustical Joint Sealants."
- G. Gypsum Board Cants (provide and install as required by code and inspector in elevator shaft, whether or not specifically shown on drawings):
 1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
 2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
 3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fire Protection."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

- G. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates:** For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports:** For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks:** Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association, or the Supreme Steel Framing System Association.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.**
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.**
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."**

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM 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 on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- D. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.
- E. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection indicated on Drawings.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 for conditions indicated.
 - 1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
 - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. Steel Construction Systems.
 - 2. Minimum Base-Steel Thickness: As indicated on Drawings.
 - 3. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) ClarkDietrich.
- 2) MarinoWARE.
- 3) Steel Construction Systems.

- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. Steel Construction Systems.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. Steel Construction Systems.
 2. Minimum Base-Steel Thickness: As indicated on Drawings or 0.033 inch.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. Steel Construction Systems.
 2. Depth: As indicated on Drawings.
 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. Steel Construction Systems.
 2. Minimum Base-Steel Thickness: As indicated on Drawings.
 3. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich; RC Deluxe at walls and floor/ceiling assemblies; provide RC-1 Pro at roof/ceiling assemblies.
 2. Configuration: Asymmetrical.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. Marino\WARE.
 - c. Steel Construction Systems.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58, or AC308 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor; torque-controlled, adhesive anchor; or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Ceiling & Wall Solutions.
 - b. Certainteed; SAINT-GOBAIN.
 - c. Rockfon (Rockwool International).
 - d. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- A. Z-Shaped Furring Members:
1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- B. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide, in place, all Drywall Work and accessories as shown on Drawings, as specified herein, and as required for the complete installation, including but not limited to:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Texture finishes.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
 - 3. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 4. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
 - 5. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

- A. Product Data: for each type of product.
- B. Samples: For the following products:
 - 1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.3 REFERENCE STANDARD

- A. Comply with all applicable requirements of Gypsum Association (GA) GA-216 "Recommended Specifications for the Application and Finishing of Gypsum Board", and Underwriter's Laboratories (U.L.) "Fire Resistance Index".

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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.
- B. Gypsum Wallboard: Fed. Spec. SS-L-30, Type III, Class I, Style 3, tapered-edge, and Grade and Form specified below. Supply wallboard in 48 inch widths and in lengths that result in minimum of joints. Products shall be as manufactured by USG, National Gypsum, or Certainteed.
 - 1. 5/8-inch Type "X" gypsum wallboard as indicated for fire resistive rated assemblies.
 - 2. 5/8-inch fire code Type "X" water resistive gypsum wallboard as indicated for fire resistive rated bathroom tub and shower walls and ceilings.
 - 3. 1-inch Gypsum Liner Panels as indicated for fire resistance rated assemblies.
 - 4. 1-inch Gypsum Liner Panels as indicated for fire resistance rated assemblies, mold and mildew resistant for exposure to outside fresh air in attics and shafts.
- C. Ceiling Texture: Provide Orange Peel texture at all gypsum board ceilings in apartments. Texture shall be approved by the Owner from actual job site samples prior to proceeding with texturing the entire project. Apartment building common area ceilings and all Clubhouse ceilings shall be finished smooth.
- D. Wall Texture: Clubhouse walls and Apartment unit and common area walls shall be finished smooth.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Certainteed; SAINT-GOBAIN.
 - b. National Gypsum Company.
 - c. USG Corporation.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. National Gypsum Company.
 - c. USG Corporation.
 2. Core: 5/8 inch, Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TRIM ACCESSORIES

- A. Fasteners: Provide fasteners as required to meet USG recommendations for each type of gypsum wallboard. Fasteners shall also be compliant with rules for the rated assembly that are installed in.
- B. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 2. Shapes:
 - a. Cornerbead: Angle-shaped, with wings not less than 7/8-inch wide and perforated for nailing and joint treatment, or with combination metal and paper wings, bonded together, not less than 1-1/4-inch wide and suitable for jointing.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint: Control joints shall be USG #093 or equal at locations recommended by the Gypsum Association.
 - f. Provide "H" studs as required for installation of gypsum liner panels.
- C. Aluminum Trim – Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Gordon Inc.
 - c. Pittcon Industries.
 - d. Tamlyn.

2. Aluminum: alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape: (USG "Perf-A-Tape" reinforcing tape):
 1. Interior Gypsum Board: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Board ("Duraboard" joint compound): For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints 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 setting-type, sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. 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.
- 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: Sheetrock Brand Acoustical sealant as manufactured by USG or approved equal installed at both ends and top of all unit demising walls.
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

- G. Compound Water: If approved joint system requires job addition of water, use only clean, potable water
- H. Other Materials: Any and all other materials, not specifically described but required for a complete and operable installation of the Work, shall be new, first quality of their respective kinds and subject to Architect's approval.

2.7 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. National Gypsum Company.
 - c. USG Corporation.
 - 2. Texture: Orange peel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All work herein requires coordination with trades whose work connects with, is affected or concealed by gypsum board. Prior to gypsum board installation, carefully inspect the installed Work of all other Trades and verify such work is complete and that drywall may be installed in strict accordance with all pertinent codes and regulations, manufacturer's recommendations as approved by Architect, and the original design. Do not install gypsum board until all unsatisfactory conditions have been corrected to Architect's approval.
- B. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. When ambient outdoor temperatures are below 55 F, maintain continuous, uniform, comfortable building working temperatures of not less than 55 F for a minimum period of 48 hours prior to, during, and following application of gypsum board joint treatment materials or bonding of adhesives.
- C. Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application.

- D. Install gypsum wallboard materials in strict accordance with the fire resistive rated assemblies indicated on the plans.
- E. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- F. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- G. Install wall/partition boards vertically if required to avoid end butt joints.
- H. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Provide vinyl casing beads at all gypsum wallboard terminations and especially at windows. Provide metal corner beads at all exterior corners.
- K. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints. Apply joint compound in two coats not including prefilling. Sand between coats and after last coat.
- L. All gypsum board surfaces shall be left clean and true to receive finish without further sanding.
- M. Texture finish for apartment unit ceilings and walls shall be in strict accordance with manufacturer's instruction. Spray so that uniform texture is produced without starred spots or other evidence of thin application and free of application patterns. Remove any texture droppings or overspray from door frames, windows, and other adjoining work. Prepare sample area for approval of texture prior to beginning actual application.
- N. All construction systems and installation shall conform to the current recommendations of the material's manufacturer and to the applicable requirements of governing codes, for the particular work.
- O. If framing members are out of alignment, bowed or warped, correct to make true surfaces before application of board; use correction method approved by Architect. Make finish walls or ceilings plumb and level, free of unevenness at joints and without ridges, bows or warps.
- P. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- Q. 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.

- R. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- S. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- T. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- U. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

- 1. Type "X" water resistive gypsum wallboard: as indicated for fire resistive rated bathroom tub and shower walls and ceilings.
- 2. Type X: as indicated and for fire resistive rated bathroom tub and shower walls and ceilings.
- 3. Type C: As indicated on Drawings and where required for specific fire-resistance-rated assembly indicated.
- 4. 1-inch Gypsum Liner Panels as indicated for fire resistance rated assemblies.
- 5. 1-inch Gypsum Liner Panels as indicated for fire resistance rated assemblies, mold and mildew resistant for exposure to outside fresh air in attics and shafts.

B. Single-Layer Application:

- 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
- 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect, and as follows:
1. Control joints in corridor walls and ceilings shall be installed so that the linear dimension between control joints does not to exceed 30 feet and the total area between control joints does not exceed 900 square feet.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use where indicated.
- D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated, for unit and common areas.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - 5. Level 5: At all Clubhouse walls exposed to public view (except at pool equipment and mechanical rooms), and where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 INSTALLATION OF TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Glazed wall tile.
3. Waterproof membranes.
4. Crack isolation membranes.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units, glass mat, water resistant backer board.

1.2 DEFINITIONS

- A. General:** Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size:** Actual tile size, excluding spacer lugs.
- C. Module Size:** Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.
1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data:** For each type of product.
- B. Shop Drawings:** Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples:**
1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.

- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Porcelain Tile Type: Glazed.

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Daltile; Florentine.
- 2. Face Size: 12 by 24 inches.
- 3. Thickness: 5/16 inch.
- 4. Dynamic Coefficient of Friction: Not less than 0.42.
- 5. Tile Color and Glaze: Carrara FL06 Matte.
- 6. Grout Color: Custom Building Products; Prism #542 Graystone Gray.
- 7. Pattern: Stack bond installation.
- 8. Trim Units: No bullnose. Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

B. Glazed Wall Tile Type:

- 1. Products: Subject to compliance with requirements, provide the following:
 - a. American Marazzi Tile, Inc; Costa Clara.
- 2. Module Size: 3 by 12 inches.
- 3. Thickness: 5/16 inch.
- 4. Tile Color: CC85 Ocean Drive.
- 5. Grout Color: MAPEI 47 Charcoal.
- 6. Pattern: 50% offset, running bond installation.
- 7. Mounting:
 - a. Factory, back mounted.
- 8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile.

2.4 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Noble Company (The).
 - 2. Nominal Thickness: 0.040 inch.
- C. Waterproof Membrane, Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
- D. Waterproof Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. H.B. Fuller Construction Products Inc. / TEC.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.

2.5 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Fabric-Reinforced, Fluid-Applied: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. H.B. Fuller Construction Products Inc. / TEC.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.

2.6 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.

B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. MAPEI Corporation.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.7 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. High-Performance Tile Grout: ANSI A118.7.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Custom Building Products ; Prism® Ultimate Performance Grout. or a comparable product by one of the following:
 - a. H.B. Fuller Construction Products Inc. / TEC.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
2. Polymer Type:
 - a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
 - b. Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring and wall applications; white zinc alloy exposed-edge material.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Blanke Corporation.
 - b. Schluter Systems L.P.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. Southern Grouts & Mortars, Inc.
 - c. Summitville Tiles, Inc.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed, or thinset mortar, comply with surface finish requirements in ANSI A108.01 for installations indicated.

- a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile floors in laundries.
 - d. Tile floors consisting of tiles 8 by 8 inches or larger.
 - e. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/16 inch.
 - 2. Porcelain Tile: 1/4 inch.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated. Install at exposed edges of wall tile.
- K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF WATERPROOF MEMBRANES

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 INSTALLATION OF CRACK ISOLATION MEMBRANES

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic-rubber base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER (TPR) BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Roppe Corporation; 700 Series Wall Base or a comparable product by one of the following:
 - 1. Armstrong Flooring, Inc.
 - 2. Armstrong World Industries, Inc.
 - 3. Flexco.
 - 4. Johnsonite; a Tarkett company.
 - 5. Nora by Interface.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous) or II (layered).
 - 2. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings.
 - c. Style C, Butt to: Provide in areas indicated.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As selected by Architect from manufacturer's full range.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Product Schedule: For floor tile.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE (LVT) – RESIDENTIAL UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group; a Berkshire Hathaway company; Reside 8 Mil, Style Number 4099V.
- B. Thickness: 0.080 inch.
- C. Size: 6 inches by 47 inches.
- D. Color: 94564 Contentment.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles in pattern of colors and sizes indicated.

- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Section 096816 "Sheet Carpeting" for carpet roll goods.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Residential II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Kraus Flooring; 7240 Perspective.
- B. Color: 07 Balance.
- C. Fiber Content: 100 percent polypropylene.
- D. Stitches: 11 stitches per inch.
- E. Primary Backing/Backcoating: Manufacturer's standard composite materials.
- F. Secondary Backing: Manufacturer's standard material.
- G. Size: 19.7 by 19.7 inches.
- H. Applied Treatments:
 - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
- I. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.22 W/sq. cm according to NFPA 253.
2. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
5. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
6. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
7. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - b. Alkalinity Test: Comply with ASTM F 710.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Wood Subfloors: Verify the following:
 1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."

2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Metal Subfloors: Verify the following:
 1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tufted carpet.
2. Carpet cushion.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
2. Section 096813 "Tile Carpeting" for modular carpet tiles.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics and durability.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch-square Sample.

C. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Residential II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:

- a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
 - b. Loss of tuft bind strength.
 - c. Excess static discharge.
 - d. Delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Engineered Floors MultiFamily, a brand of Engineered Floors; Finally Here Plus, E166.
- B. Color: 255 Carbon Crystals.
- C. Fiber Content: 100 percent polyester.
- D. Primary Backing: Manufacturer's standard material.
- E. Secondary Backing: Manufacturer's standard material.
- F. Backcoating: Manufacturer's standard material.
- G. Applied Treatments:
 - 1. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.2 CARPET CUSHION

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product as selected by Interior Designer.
- B. Polyurethane-Foam Cushion: Rebonded.
 - 1. Thickness: 7/16-inch.
- C. Performance Characteristics:
 - 1. Critical Radiant Flux Classification: Not less than 0.22 W/sq. cm according to NFPA 253.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet and carpet cushion manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.
- C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with the Carpet and Rug Institute's CRI 104.

- D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- E. Metal Edge/Transition Strips: Extruded anodized aluminum with hammered texture of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints. Color to be selected by Architect from manufacturers full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - b. Alkalinity Test: Comply with ASTM F 710.
 - c. Perform additional moisture tests recommended in writing by adhesive, carpet cushion, and carpet manufacturers. Proceed with installation only after substrates pass testing.
- D. Wood Subfloors: Verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."
 - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using

solvents. Use mechanical methods recommended in writing by adhesive, carpet, and carpet cushion manufacturers.

- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Comply with the Carpet and Rug Institute's CRI 104 and carpet and carpet cushion manufacturers' written installation instructions for the following:
 - 1. Direct-glue-down installation.
 - 2. Double-glue-down installation.
 - 3. Stretch-in installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
 - 1. Stretch-in Carpet Installation: Install carpet cushion seams at 90-degree angle with carpet seams.
- C. Install as indicated on Drawings.
- D. Install borders with mitered corner seams.
- E. Do not bridge building expansion joints with carpet.
- F. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet cushion and adhesive manufacturers.

END OF SECTION 096816

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Product Schedule: Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 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. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Behr Paint Company; Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Coronado Paint; Benjamin Moore & Co.
 - 4. Kelly-Moore Paints.
 - 5. PPG Paints; PPG Industries, Inc.
 - 6. Pratt & Lambert; a subsidiary of The Sherwin-Williams Company.
 - 7. Sherwin-Williams Company (The).
 - 8. Valspar; a brand of The Sherwin-Williams Company.
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- B. Colors: As indicated on Drawings.

2.3 PRIMERS

- A. Exterior, Alkyd/Oil Wood Primer: Alkyd/oil-based primer that is resistant to extractive bleeding when applied to wood substrates with less than 15 percent moisture content; formulated for sag, mold, and microbial resistance; for hiding stains; and for use on exterior wood subject to extractive bleeding.
- B. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.

2.4 FINISH COATINGS

- A. Exterior Latex Paint, Low Sheen: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as concrete, and primed wood.
 - 1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

- B. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as primed wood and metal.
 - 1. Gloss Level: Manufacturer's standard semigloss finish.
- C. Textured Latex Coating, Low Sheen: Water-based, pigmented coating that contains sand or other hard aggregate and is formulated for use on concrete surfaces.
 - 1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
 - 2. Aggregate Size: Manufacturer's standard.
- D. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
 - 1. Gloss Level: Manufacturer's standard semigloss finish.

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. Fiber-Cement Board: 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Exterior Gypsum Board Substrates: Verify that finishing compound is dry and sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- E. 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 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7/NACE No. 4.
 4. SSPC-SP 11.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and remove sanding dust.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- I. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.

4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. 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.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex Aggregate System:

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Textured latex coating, low sheen.

B. Steel and Iron Substrates:

1. Water-Based, Light Industrial Coating System:

- a. Prime Coat: Shop primer specified in Section in which substrate is specified.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior, water-based, light industrial coating, semigloss.

C. Galvanized-Metal Substrates:

1. Water-Based, Light Industrial Coating System:

- a. Prime Coat: Water-based, galvanized-metal primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior, water-based, light industrial coating, semigloss.

D. Exposed Wood-Framing Substrates:

1. Latex over Alkyd Primer System:

- a. Prime Coat: Exterior, alkyd/oil wood primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior latex paint, low sheen.

E. Dressed-Lumber Substrates: Trellis Beams and Columns.

1. Latex over Alkyd Primer System:

- a. Prime Coat: Exterior, alkyd/oil wood primer.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior latex paint, low sheen.

F. Fiber-Cement Board Substrates: Siding, Trim, and Panels.

1. Latex System:

- a. Prime Coat: Matching topcoat.
- b. Intermediate Coat: Matching topcoat.
- c. Topcoat: Exterior latex paint, low sheen.

G. Exterior Gypsum Board Substrates:

1. Latex Aggregate System:

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Textured latex coating, low sheen.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Water-based finish coatings.
 - 3. Floor sealers and paints.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 2. Section 055213 "Pipe and Tube Railings" for shop painting pipe and tube railings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include preparation requirements and application instructions.
 - 2. Indicate VOC content.
- B. Samples: For each type of topcoat product.
- C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Coronado Paint; Benjamin Moore & Co.
 - 3. PPG Paints.
 - 4. Pratt & Lambert.
 - 5. Sherwin-Williams Company (The).
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated in a color schedule.

2.3 PRIMERS

- A. Interior Latex Primer Sealer: Water-based latex sealer used on gypsum wallboard surfaces.
- B. Interior Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on interior wood subject to extractive bleeding.

2.4 WATER-BASED FINISH COATS

- A. Interior, Latex, Flat: Pigmented, water-based paint for use on primed/sealed interior gypsum board, and on primed wood and metals.
 - 1. Gloss and Sheen Level: Manufacturer's standard flat finish.
- B. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior gypsum board, and on primed wood and metals.

1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- C. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior gypsum board, and on primed wood and metals.
 1. Gloss Level: Manufacturer's standard semigloss finish.
- D. Interior, Latex, High-Performance Architectural Coating, Low Sheen: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
 1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- E. Interior, Latex, High-Performance Architectural Coating, Eggshell: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
 1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- F. Interior, Latex, High-Performance Architectural Coating, Semigloss: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
 1. Gloss Level: Manufacturer's standard semigloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Wood: 15 percent.
 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. 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 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Finish Carpentry: Wood trim.
 1. Latex over Latex Primer System:
 - a. Prime Coat: Interior latex primer for wood.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, semigloss.
 2. High-Performance Architectural Latex System:
 - a. Prime Coat: Interior latex primer for wood.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, high-performance architectural coating, semigloss.
- B. Spray-Textured Ceiling Substrates:
 1. Latex, Flat System: Spray applied:
 - a. Prime Coat: Matching topcoat.
 - b. Topcoat: Interior, latex, flat.
 2. Latex System: Spray applied:
 - a. Prime Coat: Matching topcoat.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, flat.

C. Gypsum Board Substrates:

1. Latex over Latex Sealer System:
 - a. Prime Coat: Interior latex primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, satin, eggshell.
2. High-Performance Architectural Latex System:
 - a. Prime Coat: Interior latex primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

END OF SECTION 099123

SECTION 101400 SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Supply and install all signage, letters and numbers as shown on Drawings and this Specification, and as required by the authorities having jurisdiction.
- B. Related Requirements:
 - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 2. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 3. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
 - 4. Section 265213 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.
- C. Signage Process Overview:
 - 1. Owner shall provide direction on quantities, location, dimensions, logos, and graphics for signage contractor to prepare shop drawings for review.
 - 2. Owner shall review shop drawings for quantities, location of non-code required signage, text, graphics, materials, etc.
 - 3. Architect shall review shop drawings for compliance with the contract documents, including code requirements.
 - 4. Contractor shall provide blocking, supports, and power to locations where required. Signage contractor shall provide contractor with requirements with sufficient time to coordinate with other trades.

1.2 ALLOWANCES

- A. The Contractor shall furnish and install all required and necessary signage for the Project under an allowance of \$20,000.00. This amount shall cover the cost of materials and labor to supply and install signage selected by the Owner only. Colors and Finishes shall be as selected by Owner.
- B. This allowance amount shall not include amounts for Contractor's / Subcontractor's overhead and profit.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.
- B. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.4 COORDINATION

- A. Coordinate all with other Trades whose Work affects signage installations. Before proceeding, make certain all required inspections have been made.

- B. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- C. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Shop drawings:
 - 1. Include location plan for all signage, referenced to sign elevations.
 - 2. Include fabrication and installation details and attachments to other work.
 - 3. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 4. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign.
 - 5. Submittals shall be submitted to the Owner and Architect for review.
- B. Samples: Submit one sample of each type of signage material selected plus as many as required by Contractor. Mark with manufacturer's name and space where signage is to be installed.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage device and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SIGNS

- A. Unit and Room Identification Signage:
 - 1. Unit Identifications signage: Provide and install unit numbering signage at each unit.
 - 2. Room Identification signage: Provide and install signage for all other rooms and spaces.
 - 3. Occupant Load signage: Provide and install for assembly spaces with 50-person capacity or greater.
 - 4. Exterior accessed sprinkler rooms: Provide and install identification sign in compliance with jurisdiction and code requirements.
 - 5. Stairway identification: Provide and install signage at each floor inside and outside stair as required by code.
 - 6. Storage Locker numbering.
 - 7. Accessible toilet signage: Provide and install.
- B. Wayfinding and Informational Signage: Provide and install the following:
 - 1. Electrical charging station location signage, paving and wall/overhead signage.
 - 2. Accessible parking vertical signage and logo.
 - 3. Fitness equipment use and rules.
 - 4. Dog Park rules signage.
 - 5. Directional signage, in quantities and locations directed by Owner.
- C. Panel Signage – Provide and install where indicated and/or requested by Owner. Provide and coordinate power, blocking and anchorage requirements.
 - 1. Canopy Signage – backlit, internally lit sign. Applied, non-integral to building.
 - 2. Monument Signage – Owner shall provide graphic, branding and logos to be applied to monument signage.
- D. Refer to interior design package for additional signage requirements and information.

2.3 PERFORMANCE REQUIREMENTS

- C. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine all substrates, areas, and conditions to receive Work, with installer present, for compliance with the requirements for installation tolerances and other conditions affecting performance of the Work. Report in writing to General Contractor, with a copy to Architect, any detrimental conditions. Failure to observe this injunction constitutes a waiver to any subsequent claims to the contrary and holds Contractor responsible for any corrections Architect may require. Commencement of Work will be construed as acceptance of all substrates.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

- C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Contractor shall install all signage as directed by Owner or as required by authorities with jurisdiction over this project in strict accordance with the manufacturers printed instructions and directions.
- B. Letters, Symbols and Numerals composing the signage shall comply with all applicable codes, ordinances, and regulations of all governing bodies with jurisdiction over this project.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Childcare accessories.
 - 4. Underlavatory guards.
 - 5. Custodial accessories.
- B. Related Requirements:
 - 1. Section 088300 "Mirrors" for frameless mirrors.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.
- B. Clubhouse accessory items shall be provided by American Specialties, Bradley or Bobrick. Coordinate with Interior Designer Drawings and Schedules.

2.3 PRIVATE-USE BATHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of private-use bathroom accessory from single source from single manufacturer.
- A. Grab Bar:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc; B-6806 Series.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
 - 4. Outside Diameter: 1-1/2 inches.
 - 5. Configuration and Length: As indicated on Drawings.
- B. Private-Use Toilet Tissue Dispenser:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Design House; Geneva Single Post Toilet Paper Holder, Model #560383 (Satin Nickel).
 - 2. Description: Single-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Capacity: Designed for 4-1/2- or 5-inch-diameter tissue rolls.
 - 5. Material and Finish: Satin Nickel.
- C. Private-Use Robe Hook:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Design House; Geneva Double Robe Hook, Model #560342 (Satin Nickel).
 - 2. Description: Double-prong unit.

3. Material and Finish: Satin Nickel.

D. Private-Use Towel Bar:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Design House; Geneva Towel Bar, Model #560300 (Satin Nickel).
2. Mounting: Flanges with concealed fasteners.
3. Length: 24 inches.
4. Material and Finish: Satin Nickel.

E. Private-Use Towel Ring:

1. Basis-of-Design Product: Subject to compliance with requirements, provide (Satin Nickel).
2. Description: Pin projecting approximately 2-1/2 inches from wall with circular ring.
3. Material and Finish: Satin Nickel.

2.4 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

B. Diaper-Changing Station:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Koala Kare Products; Bobrick Washroom Equipment, Inc.; KB110-SSWM or a comparable product by one of the following:
 - a. ASI American Specialties, Inc.; ASI Group.
 - b. Bradley Corporation.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 50-lb static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color.

- C. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckaroos, Inc.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Custodial Mop and Broom Holder:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc; #B-224.
 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 3. Length: 36 inches.
 4. Hooks: Three.
 5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
 - b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.7 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

2.8 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 102819 - SHOWER ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Frameless shower doors and enclosures.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for shower doors and enclosures.
- B. Shop Drawings: For tub and shower doors and enclosures.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples: For each type of exposed finish.
- D. Product Schedule: For tub and shower doors and enclosures. Use same designations where indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For tub and shower doors and enclosures to include in maintenance manuals.

1.6 FIELD CONDITIONS

- A. Verify dimensions by field measurements before fabrication and indicate on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tub and shower doors and enclosures that fail in materials or workmanship within specified warranty period, without monetary limitation.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection.

- b. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FRAMELESS ENCLOSURES

- A. Frameless glass panels with mounting and operating hardware of types and sizes required to support imposed loads. Subject to compliance with the requirements, provide enclosures by the following:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Arizona Shower Door; Lite Euro.
- B. Hardware and Trim: Manufacturer's standard units as indicated and as required for complete installation.
 - 1. Materials:
 - a. Aluminum:
 - 1) Finish: Brushed Nickel.
- C. Bypass Doors: Sliding units suspended from extruded-aluminum header track by fully adjustable, sealed, heavy-duty ball-bearing rollers. Self-draining sill tracks with nylon panel guides. Molded jamb bumpers with concealed fasteners.
 - 1. Door Pulls: Full-door-width, single-sided towel bars.
 - 2. Safety Clip System: Manufacturer's standard safety device designed to prevent doors from falling off sliding track.
- D. Glazing:
 - 1. Clear fully tempered. Comply with requirements in Section 088000 "Glazing."
 - 2. Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction.
 - a. Glass Nominal Thickness: 1/4-inch.
 - b. Clear Glass: ASTM C1048, Type I, Quality-Q3, Class I (clear), Kind FT.
- E. Fasteners: Manufacturer's standard stainless steel or other noncorrosive fasteners.
- F. Sealant: Mildew-resistant, single-component, nonsag, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, for Use NT.
- G. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B209.
 - b. Extrusions: ASTM B221.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare and install per manufacturer's written instructions unless more stringent requirements are contained in NGA's "GANA Glazing Manual."
- B. Clean substrates, removing projections, filling voids, and sealing joints.
- C. Set units level, plumb, and true to line, without warp or rack of frames and panels, and anchor securely in place.
- D. Fasten components securely in place, with provisions for thermal movement. Install with concealed fasteners unless otherwise indicated.
- E. Install components to drain and return water to tub or shower.
- F. Install doors to produce smooth operation and tight fit at contact points.
- G. Repair, refinish, or replace components damaged during installation.

3.2 ADJUSTING AND CLEANING

- A. Adjust operating parts and hardware for smooth, quiet operation and watertight closure. Lubricate hardware and moving parts.
- B. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 102819

SECTION 103116 MANUFACTURED GAS FIREPLACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manufactured gas burning, direct vent fireplaces.
- B. Accessories.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI Z223.1 - National Fuel Gas Code.
- C. ANSI Z21.88 - Vented Gas Fireplace Heaters.

1.3 SUBMITTALS

- A. 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.
- B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- C. Manufacturers warranty as executed by the manufacturer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of fireplaces and stoves continuously for 30 years.
- B. Installer Qualifications: Installer of fireplaces and stoves continuously for 5 years.
 - 1. Licensed as required by local codes.
 - 2. National Fireplace Institute certified installers required.
 - 3. Factory-trained installers from authorized dealers required.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

1.6 WARRANTY

- A. Limited lifetime warranty, including glass, heat exchanger, burners, combustion chamber, and firebox.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. See-Thru Gas Fire Place: Shall be DaVinci Custom Timber Fire Collection natural gas fireplace 60-inch wide x 30-inch tall with clear tempered glass fronts both sides, with vented galvanized steel housing assembly with fresh air vents and dampers, exhaust flue, flue cap, electronic ignition, crushed glass bedding in colors as selected by Owner, controls, safety valves manual shutoffs, control timers.

2.2 EQUIPMENT

- A. General:
 - 1. Provide all components and accessories required for a complete, functional unit.
 - 2. Comply with applicable building codes.
 - 3. Comply with ANSI Z21.50 and ANSI Z21.88.
 - 4. Equipment, when installed, must be electrically grounded in accordance with local codes and with the National Electrical Code ANSI/NFPA 70.
 - 5. Vent system: Manufacturer's standard.

2.3 ACCESSORY MATERIALS

- A. Shut-Off Valve: Manufacturer's Standard.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify proper power supply and fuel source are available.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare framing opening and supporting surfaces using the methods recommended by the manufacturer and those that comply with local codes for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and the requirements of authorities having jurisdiction.
- B. Fireplaces must be electrically grounded and installed in accordance with local codes or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70.
- C. Use manufacturer's fireplace and venting guidelines for minimum clearances to combustibles, walls, floor and finishes.
- D. Fireplaces must be vented in accordance with local codes or, in the absence of local codes, with the ANSI Z223.1.
- E. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch up paint recommended by the manufacturer; make imperfections invisible to the unaided eye from a distance of 5 feet.

3.4 PROTECTION

- A. Protect installed products, especially glass and faceplate finishes, until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 103116

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.
- C. Coordinate cabinet fire rating with wall construction and details.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; AL-2409-R1 or AL-2409-R5 cabinets in non-rated walls and FS 2409-R1 or FS 2409-R3 cabinets in rated walls, or a comparable product by one of the following:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Rated/Nonrated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- F. Cabinet Trim Material: Same material and finish as door.
- G. Door Material: Extruded-aluminum shapes.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color:
 - a. Clear transparent acrylic sheet.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

L. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - a. Color: As selected by Architect from full range of industry colors and color densities.
3. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), with Finish 1 (smooth or polished).

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 4. Fire-Rated Cabinets:
 - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

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. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.

- b. Faulty operation of valves or release levers.
- 2. 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 indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; Model MP5 or a comparable product by one of the following:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Potter Roemer LLC; a Division of Morris Group International.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. 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 in Steel Container: UL-rated 1-A:10-B:C, 2.5-lb and 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel 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 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Provide one wall mounted fire extinguisher in each Apartment unit and fire extinguishers mounted in cabinets in the Apartment building corridors and the Clubhouse.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated. Mount 54 inches above finished floor to top of fire extinguisher.

END OF SECTION 104416

SECTION 105700 WIRE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wire shelving.

B. Related Requirements:

1. Section 062023 "Interior Finish Carpentry" for wood shelving.

1.2 SUBMITTALS

- A. Product Data: Submit for each product indicating materials, dimensions, profiles, textures and colors. Include installation instructions.
- B. Shop Drawings: Submit shop drawings indicating plans, elevations, details of construction, and relationship with adjacent construction.

1.3 COORDINATION

- A. Coordinate with all other trades whose Work relates to items specified herein for placing of all required backing to insure proper locations.

1.4 DELIVERY AND STORAGE

- A. Deliver and store all items specified herein in dry protected areas. Keep free of corrosion or other damage. Replace any damaged items at no cost to the Owner.

1.5 SUBMITTALS

- A. Submit manufacturer's product data and installation instructions for approval.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Loading: Anchored to drywall.

1. Support braces or wall brackets required every 36 inches.
2. Back clips drywall mounted every 12 inches beginning 1.5 to 2 inches from sidewalls. Open ended shelves require a second back clip 2 inches from the end clip and all purpose clamp into the stud closest to the open end.

- B. Performance: Load capacities 30 to 80 pounds per foot dependent upon shelf width and configuration.

2.2 WIRE SHELVING

- A. All wire shelving shall be Organized Living (Schulte Corporation), Closet Maid or equal, constructed of PVC coated grade C1008 cold drawn steel rods with 100,000 psi tensile strength.
- B. Wire shelving in walk-in closets and coat closets shall be 12" deep wire shelves with superslide hanging rods complete with all wall clips, end caps, anchors, etc. as required for a complete installation.
- C. Wire shelving for linen storage in reach-in closets shall be (5) 15" deep x width indicated, fixed shelves complete with all wall clips, end caps, anchors, support poles, pole shelf support clips, etc. as required for a complete installation.
- D. Wire shelving in all laundry rooms and walk-in pantries shall be 12" deep x width indicated fixed shelf complete with all support brackets, anchors, end caps, etc. as required for a complete installation.
- E. Built-In Wood Laminate Shelving: VUE by Organized Living Linen/Pantry DL4 16-inch-deep shelving; provide in Walk-In-Closet locations as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all wire shelving per manufacturer's written instructions.

END OF SECTION 105700

SECTION 107313 - AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed awnings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for awnings.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, mounting heights, and attachment details.
2. Detail fabrication and assembly of awnings.
3. Show locations for blocking, reinforcement, and supplementary structural support.

C. Samples: For each exposed product and for each color and texture specified.

D. Product Schedule: For awnings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.5 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Faulty operation of operator.
2. Awning Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Alumicorp, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 AWNING FRAME AND ACCESSORY MATERIALS

- A. Steel:

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Tubing: ASTM A500/A500M.
3. Galvanized Steel Tubing: ASTM A787/A787M.
4. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40).

- B. Aluminum: Alloy and temper recommended by awning manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.

1. Aluminum Plate and Sheet: ASTM B209.
2. Aluminum Extrusions: ASTM B221.
3. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, standard weight (Schedule 40).
4. Drawn Seamless Tubing: ASTM B210.

- C. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Wood Screws: ASME B18.6.1.
2. Lag Bolts: ASME B18.2.1.

3. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, zinc coated.
 4. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
 5. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E1512 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
 - D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- 2.4 FIXED AWNINGS
- A. Fixed Awnings:
 1. Frame Fabrication: Fabricate awning frames from aluminum. Preassemble in 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. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 2. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 4. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and 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.
 5. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure awnings in place and to properly transfer loads.
 - B. Aluminum Finish: Baked-enamel or powder-coat finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, lighting, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install awnings at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
- C. Slip fit frame connections accurately together to form hairline joints, and tighten to secure.
- D. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 1. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. 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.
- E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- G. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall and roof assemblies.

3.3 CLEANING AND PROTECTION

- A. Touch up factory-applied finishes to restore damaged or soiled areas.
- B. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 107313

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Kitchen exhaust ventilation.
3. Refrigeration appliances.
4. Cleaning appliances.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.

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. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Field quality-control reports.

D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:** For each residential appliance to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranties:** Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 RANGES

- A. ADA Electric Range: Slide-in range with one oven and complying with AHAM ER-1.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; JS645SLSS.
 2. Width: 30 inches.
 3. Electric Burner Elements: Four.
 - a. Coil Type: Manufacturer's standard.
 - b. Radiant Type: Two 1200 W and two 3100 W.
 - c. Induction Type: Manufacturer's standard.
 - d. Controls: Digital panel controls, located on front.
 4. Oven Features:
 - a. Capacity: 5.3 cu. ft.
 - b. Operation: Baking and pyrolytic self-cleaning or catalytic continuous cleaning.
 - c. Broiler: Located in top of oven.
 - d. Oven Door: Counterbalanced, removable, with observation window and full-width handle.
 - e. Electric Power Rating:
 - 1) Oven: Manufacturer's standard.
 - 2) Broiler: Manufacturer's standard.
 - f. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.
 5. Anti-Tip Device: Manufacturer's standard.
 6. Electric Power Supply: 208/240 V, 60 Hz, 1 phase, 40 A.
 7. Material: Stainless steel with manufacturer's standard cooktop.
- B. Electric Range: Slide-in range with one oven and complying with AHAM ER-1.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; JB645RKSS.

2. Width: 30 inches.
3. Electric Burner Elements: Four.
 - a. Coil Type: Manufacturer's standard.
 - b. Radiant Type: Two 1200 W and two 3100 W.
 - c. Induction Type: Manufacturer's standard.
 - d. Controls: Digital panel controls, located on splash panel at rear of rangetop.
4. Oven Features:
 - a. Capacity: 5.3 cu. ft.
 - b. Operation: Baking and pyrolytic self-cleaning or catalytic continuous cleaning.
 - c. Broiler: Located in top of oven.
 - d. Oven Door: Counterbalanced, removable, with observation window and full-width handle.
 - e. Electric Power Rating:
 - 1) Oven: Manufacturer's standard.
 - 2) Broiler: Manufacturer's standard.
 - f. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.
5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 208/240 V, 60 Hz, 1 phase, 40 A.
7. Material: Stainless steel with manufacturer's standard cooktop.

2.3 MICROWAVE OVENS

A. ADA Microwave Oven:

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; PES7227SLSS.
2. Mounting: Undercabinet.
3. Type: Conventional.
4. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 20 inches.
 - c. Height: 14 inches.
5. Capacity: 2.2 cu. ft.
6. Oven Door: Door with observation window and pushbutton latch release.
7. Microwave Power Rating: Manufacturer's standard.
8. Electric Power Supply: 120 V, 60 Hz.
9. Controls: Digital panel controls and timer display.
10. Material: Stainless steel.

B. Microwave Oven:

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; JNM3163RJSS.

2. Mounting: Undercabinet.
3. Type: Conventional.
4. Dimensions:
 - a. Width: 30 inches.
 - b. Depth: 16 inches.
 - c. Height: 16-7/16 inches.
5. Capacity: 1.6 cu. ft.
6. Oven Door: Door with observation window and pull handle.
7. Exhaust Fan: Two-speed fan, nonvented, recirculating type with charcoal filter and with manufacturer's standard capacity.
8. Microwave Power Rating: Manufacturer's standard.
9. Electric Power Supply: 120 V, 60 Hz.
10. Controls: Digital panel controls and timer display.
11. Material: Stainless steel.

2.4 KITCHEN EXHAUST VENTILATION

A. Overhead Exhaust Hood:

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; JVB3300SJSS.
2. Type: Wall-mounted, exhaust-hood system.
3. Dimensions:
 - a. Width: 30 inches.
 - b. Depth: 20 inches.
4. Exhaust Fan: Two-speed fan built into hood and with manufacturer's standard capacity.
 - a. Venting: Nonvented, recirculating type with charcoal filter.
 - b. Fan Control: Hood-mounted fan switch, with separate hood-light control switch.
5. Duct Type: 7-inch-diameter round.
6. Finish: Stainless steel.
7. Features:
 - a. Built-in incandescent lighting.
 - b. Warming lamp socket(s).

2.5 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer and ADA Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GTE22JSNRSS.
2. Type: Freestanding.
3. Dimensions:

- a. Width: 32 inches.
 - b. Depth: 34 inches.
 - c. Height: 66 inches.
- 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: 15.25 cu. ft.
 - b. Freezer Volume: 6.68 cu. ft.
- 5. General Features:
 - a. Dual refrigeration systems.
 - b. Separate temperature controls for each compartment.
- 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Door Storage: Modular compartments and gallon-milk-container storage.
 - c. Temperature-controlled meat/deli bin.
- 7. Freezer Features: One freezer compartment with door.
 - a. Automatic defrost.
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
- 8. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
- 9. Front Panel(s): Stainless steel.
- 10. Appliance Color/Finish: Stainless steel.

2.6 DISHWASHERS

A. ADA Dishwasher: Complying with AHAM DW-1.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GDT226SSLSS.
- 2. Type: Built-in undercounter.
- 3. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 23-1/2 inches.
 - c. Height: 32-1/4 inches.
- 4. Capacity:
 - a. International Place Settings of China: 12.
- 5. Sound Level: Maximum 51 dB.
- 6. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
- 7. Rack System: PVC-coated sliding dish racks, with removable cutlery basket.
- 8. Controls: Controls with four wash cycles and hot-air and heat-off drying cycle options.

9. Features:
 - a. Waste food disposer.
 - b. Self-cleaning food-filter system.
 - c. Lock-out feature.
 - d. Half-load option.
 - e. Delay-wash option.
 - f. Digital display panel.
 - g. Water softener.
 - h. Soil-sensing water use control system.
10. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
11. Front Panel: Stainless steel.
12. Appliance Color/Finish: Stainless steel.

B. Dishwasher: Complying with AHAM DW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GDF511PSRSS.
2. Type: Built-in undercounter.
3. Dimensions:
 - a. Width: 24 inches.
 - b. Depth: 24 inches.
 - c. Height: 33-3/8 inches.
4. Capacity:
 - a. International Place Settings of China: 12.
5. Sound Level: Maximum 59 dB.
6. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
7. Rack System: PVC-coated sliding dish racks, with removable cutlery basket.
8. Controls: Controls with four wash cycles and hot-air and heat-off drying cycle options.
9. Features:
 - a. Waste food disposer.
 - b. Self-cleaning food-filter system.
 - c. Lock-out feature.
 - d. Half-load option.
 - e. Delay-wash option.
 - f. Digital display panel.
 - g. Water softener.
 - h. Soil-sensing water use control system.
10. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
11. Front Panel: Stainless steel.
12. Appliance Color/Finish: Stainless steel.

2.7 CLOTHES WASHERS AND DRYERS

A. ADA Clothes Washer: Complying with AHAM HLW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFW550SSNWW.
2. Type: Freestanding, front-loading unit.
3. Dimensions:
 - a. Width: 28 inches.
 - b. Depth: 32 inches.
 - c. Height: 39 inches.
4. Drum: Manufacturer's standard.
 - a. Capacity: 4.8 cu. ft.
5. Controls: Controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
 - a. Wash Cycles: 10 wash cycles, including regular, delicate, and permanent press.
 - b. Wash Temperatures: Five settings.
6. Electrical Power: 120 V, 60 Hz.
7. Motor: Manufacturer's standard with built-in overload protector.
8. Features:
 - a. Self-cleaning lint filter.
 - b. Unbalanced-load compensator.
 - c. Inlet Hoses: Minimum length 60 inches.
 - d. Drain Hoses: Minimum length 48 inches.
 - e. Self-leveling legs.
 - f. Spin-cycle safety switch.
 - g. End-of-cycle signal.
 - h. Extra-rinse option.
 - i. Electronic temperature control.
 - j. Water levels automatically set.
9. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
10. Appliance Finish: Enamel.
 - a. Color: White.

B. Clothes Washer: Complying with AHAM HLW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GTW220ACKWW.
2. Type: Freestanding, top-loading unit.
3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 27 inches.

- c. Height: 44 inches.
 - 4. Drum: Manufacturer's standard.
 - a. Capacity: 3.8 cu. ft.
 - 5. Controls: Controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
 - a. Wash Cycles: 10 wash cycles, including regular, delicate, and permanent press.
 - b. Wash Temperatures: Six settings.
 - 6. Electrical Power: 120 V, 60 Hz.
 - 7. Motor: Manufacturer's standard with built-in overload protector.
 - 8. Features:
 - a. Agitator: Center spindle.
 - b. Self-cleaning lint filter.
 - c. Unbalanced-load compensator.
 - d. Inlet Hoses: Minimum length 60 inches.
 - e. Drain Hoses: Minimum length 48 inches.
 - f. Self-leveling legs.
 - g. Spin-cycle safety switch.
 - h. End-of-cycle signal.
 - i. Extra-rinse option.
 - j. Electronic temperature control.
 - k. Water levels automatically set.
 - 9. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
 - 10. Appliance Finish: Enamel.
 - a. Color: White.
- C. ADA Clothes Dryer: Complying with AHAM HLD-1.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFD55ESSNWW.
 - 2. Type: Freestanding, frontloading, electric unit.
 - 3. Dimensions:
 - a. Width: 28 inches.
 - b. Depth: 32 inches.
 - c. Height: 39 inches.
 - 4. Drum: Manufacturer's standard.
 - a. Capacity: 6.2 cu. ft.
 - 5. Controls: Controls for drying cycle, temperatures, and fabric selectors.
 - 6. Electric-Dryer Power: 120/240 V or 120/208 V; 60 Hz.
 - 7. Features:
 - a. Removable lint filter.

- b. Electronic temperature and moisture-level-sensor controls.
 - c. End-of-cycle signal.
 - d. Self-leveling legs.
 - e. Built-in electrical power fuse.
- 8. Appliance Finish: Enamel.
 - a. Color: White.
- D. Clothes Dryer: Complying with AHAM HLD-1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GTX22GASKWW.
 - 2. Type: Freestanding, top loading, electric unit.
 - 3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 26-3/4 inches.
 - c. Height: 44 inches.
 - 4. Drum: Manufacturer's standard.
 - a. Capacity: 6.2 cu. ft.
 - 5. Controls: Controls for drying cycle, temperatures, and fabric selectors.
 - 6. Electric-Dryer Power: 240 V or 208 V; 60 Hz.
 - 7. Features:
 - a. Removable lint filter.
 - b. Electronic temperature and moisture-level-sensor controls.
 - c. End-of-cycle signal.
 - d. Self-leveling legs.
 - e. Built-in electrical power fuse.
 - 8. Appliance Finish: Enamel.
 - a. Color: White.

2.8 CLOTHES WASHER/DRYER COMBINATIONS

- A. Clothes Washer/Dryer Combination: Complying with AHAM HLW-1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GUD27EESNWW.
 - 2. Type: Freestanding washer/dryer unit with dual-drum design and electric dryer; washer is top loading.
 - 3. Dimensions:
 - a. Width: 27 inches.
 - b. Depth: 30 inches.
 - c. Height: 76 inches.
 - 4. Washer and Dryer Drums: Manufacturer's standard.

- a. Washer-Drum Capacity: 3.9 cu. ft.
 - b. Dryer-Drum Capacity: 5.9 cu. ft.
- 5. Washer Controls: Controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
- 6. Dryer Controls: Controls for drying cycle, temperatures, and fabric selectors.
- 7. Electric Washer/Dryer Power: 120/240 V or 120/208 V; 60 Hz.
- 8. Motor: Manufacturer's standard with built-in overload protector.
- 9. Washing Features:
 - a. Self-cleaning lint filter.
 - b. Unbalanced-load compensator.
 - c. Inlet Hoses: Minimum length 60 inches.
 - d. Drain Hoses: Minimum length 48 inches.
 - e. Self-leveling legs.
 - f. Spin-cycle safety switch.
- 10. Drying Features:
 - a. Removable lint filter.
 - b. Electronic temperature and moisture-level-sensor controls.
 - c. End-of-cycle signal.
 - d. Interior drum light.
- 11. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
- 12. Appliance Finish: Enamel.
 - a. Color: White.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113013

SECTION 122113 - HORIZONTAL LOUVER BLINDS

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. Horizontal louver blinds with polymer slats.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Springs Window Fashions; SWFcontract; Lake Forest Faux Wood Blinds or a comparable product by the following:
 - 1. Levolor.
- B. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.
 - 1. Formulation: Manufacturer's standard.
 - 2. Width: 2 inches.
 - 3. Spacing: Manufacturer's standard.
 - 4. Profile: Manufacturer's standard.
- C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrail fully encloses operating mechanisms on three sides and ends.
 - 1. Capacity: One blind per headrail unless otherwise indicated.
 - 2. Manual Lift Mechanism:
 - a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within full operating range.
 - b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
 - 3. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 - a. Tilt: Full.
 - b. Operator: Plastic wand or Dual cord.

- c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.
- 4. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.
- 5. Manual Lift-Operator and Tilt-Operator Locations: Manufacturer's standard unless otherwise indicated.
- D. Bottom Rail: Secures and protects ends of ladders and lift cords.
 - 1. Type: Manufacturer's standard.
- E. Lift Cord: Manufacturer's standard braided cord.
- F. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
- G. Valance: Manufacturer's standard.
- H. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
 - 1. Type: As indicated.
 - 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
- J. Colors, Textures, Patterns, and Gloss:
 - 1. Slats: As selected by Architect from manufacturer's full range.
 - 2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish:
 - 1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Locate so exterior slat edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
 - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122113

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Kitchen and vanity cabinets.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
3. Section 123640 "Stone Countertops."

1.2 DEFINITIONS

- A. Concealed Surfaces of Casework:** Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of casework installed directly against and completely concealed by walls or other casework, and tops of wall cabinets and utility cabinets.
- B. Exposed Surfaces of Casework:** Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- C. Semiexposed Surfaces of Casework:** Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

1.3 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework. Coordinate and cooperate with all trades whose Work relates in any way to items specified herein so Work progresses smoothly and without delay.**

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and profiles and finishes for casework.
2. Include rated capacities, operating characteristics, profiles, and finishes for hardware.

B. Shop Drawings: For residential casework.

1. Include plans, elevations, details, and attachments to other work.
2. Show materials, finishes, filler panels, and hardware, edge and backsplash profiles, methods of joining countertops and cutouts for plumbing fixtures.
3. Indicate manufacturer's catalog numbers for casework.

C. Samples: For casework and hardware finishes.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For casework.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.
- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.7 INSPECTION

- A. Examine all subsurfaces to receive Work and report in writing to General Contractor, with a copy to Architect any conditions detrimental to the installation of cabinetry. Failure to observe this injunction constitutes a waiver to any subsequent claims to the contrary and makes contractor responsible for any corrections the Architect may require. Commencement of Work will be construed as acceptance of all subsurfaces.

1.8 ANCHORAGE

- A. Furnish and install all anchorage devices required to install the item and its appurtenances, complete. Provide anchorage in ample time when required to be built in by other trades.

1.9 QUALITY ASSURANCE

- A. All cabinets shall meet or exceed the recommended minimum construction and performance standards of the National Kitchen Cabinet Association and ANSI A161.1.

PART 2 - PRODUCTS

2.1 CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following.
 - 1. Cabinet Wright
- B. Quality Standard: Provide cabinets that comply with KCMA A161.1.

- C. Door and Drawer Face Style: Flush overlay; faces cover cabinet fronts.
 - 1. Door and Drawer Fronts:
 - a. Solid-wood stiles and rails, 3/4-inch thick, with 1/4-inch-thick, veneer-faced plywood center panels.
- D. Cabinet Style: Frameless.
- E. Exposed Cabinet End Finish: Painted.
- F. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.
- G. Wall-Hung-Unit Back Panels: 3/16-inch-thick plywood fastened to rear edge of end panels and to top and bottom rails.
- H. Front Frame Drawer Rails: 3/4-by-1-1/4-inch solid wood mortised and fastened into face frame.
- I. Factory Finishing: Finish cabinets at factory.

2.2 CABINET MATERIALS

- A. Hardwood Lumber: Kiln dried to 7 percent moisture content.
- B. Softwood Lumber: Kiln dried to 10 percent moisture content.
- C. Hardwood Plywood: HPVA HP-1.
- D. Particleboard: ANSI A208.1, Grade M-2.
- E. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.
- F. Exposed Materials:
 - 1. Wood Species: Painted maple.
 - 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
 - 3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
- G. Semiexposed Materials: Unless otherwise indicated, provide the following:
 - 1. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces.
 - 2. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.
 - a. Provide material finished on both sides for shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
 - b. Provide PVC or polyester edgebanding on components with semiexposed edges.
 - c. Colors: As selected by Architect from cabinet manufacturer's full range.

- H. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; or MDF.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.
- B. Pulls: Back-mounted decorative pulls.
- C. Hinges: Concealed European-style, soft-close, self-closing hinges.
- D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 - 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 - 2. Drawers: Provide one bumper on back side of drawer front at each corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.
- B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet.
- D. Fasten casework to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.
 - a. Fasteners: No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.
- E. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

- F. Protect finished surfaces from damage or staining resulting from subsequent work. Repair or replace damaged cabinetwork, including warped or loose members.
- G. Caulk all joints between kitchen and vanity countertops and walls and joints between plumbing fixtures and countertops.

3.3 ADJUSTING AND CLEANING

- A. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 123640 - STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes stone countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For each stone, accessory, and manufactured product.
- B. Shop Drawings:
 - 1. Include plans, sections, details, and attachments to other work.
 - 2. Show locations and details of joints.
 - 3. Show direction of veining, grain, or other directional pattern.
- C. Samples: For each stone type indicated.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of stone countertops.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
 - 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
 - 2. Store stone on wood A-frames or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

2.2 GRANITE

- A. Material Standard: Comply with ASTM C615/C615M.
- B. All Apartment Units, Townhomes and all Clubhouse countertops, except Maintenance Shop countertop, shall be as selected and scheduled on the Interior Designers Materials and Finish Schedules.
- C. Outdoor grille areas shall have granite worktops per drawings.
- D. Finish: Polished.

2.3 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

- A. General: Use only adhesives formulated for stone and ceramic tile and that are recommended by their manufacturer for the application indicated.
- B. Water-Cleanable Epoxy Adhesive: ANSI A118.3.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
- C. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
- D. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and that will not stain the stone it is applied to.
 - 1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
 - 2. Color: As selected by Architect from manufacturer's full range.
- E. Plywood Subtops: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

- F. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.

2.4 STONE FABRICATION, GENERAL

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that may impair structural integrity, function, or appearance.
- B. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated.
 - 1. Dress joints straight and at right angle to face unless otherwise indicated.
 - 2. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snapping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased unless otherwise indicated.
 - 3. Finish exposed faces of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.

2.5 STONE COUNTERTOPS

- A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual VII."
- B. Nominal Thickness: Provide thickness indicated, but not less than 1-1/4 inches. Gage backs to provide units of identical thickness.
- C. Splashes: Provide 3/4-inch-thick backsplashes and end splashes unless otherwise indicated.
- D. Joints: Fabricate countertops without joints.
- E. Joints: Fabricate countertops in sections for joining in field.
- F. Cutouts and Holes:
 - 1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - 2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone countertops.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone countertops.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COUNTERTOPS

- A. Install countertops over subtops with full spread of water-cleanable epoxy adhesive.
- B. Install countertops by adhering to supports with water-cleanable epoxy adhesive.
- C. Set stone to comply with requirements indicated. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships.
- D. Space joints with 1/16-inch gap for filling with sealant. Use temporary shims to ensure uniform spacing.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- F. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splashes for filling with sealant. Use temporary shims to ensure uniform spacing.
- G. Grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.
- H. Apply sealant to joints and gaps specified for filling with sealant; comply with Section 079200 "Joint Sealants." Remove temporary shims before applying sealant.

3.3 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Remove and replace stone countertops of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective countertops.

3. Defective joints, including misaligned joints.
 4. Interior stone countertops not complying with other requirements indicated.
- C. Clean stone countertops no fewer than six days after completion of installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that may damage stone.
- D. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 123640

SECTION 142123.16 - MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Machine-room-less electric traction passenger elevators.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 051200 "Structural Steel Framing" for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills.
3. Section 055000 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills.
 - e. Pit ladders.
 - f. Cants made from steel sheet in hoistways.

1.2 DEFINITIONS

- A.** Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B.** Service Elevator: A passenger elevator that is also used to carry freight.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
2. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For each type of exposed finish involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Submit manufacturer's or Installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

A. Coordinate installation of inserts, sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish

templates, inserts, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

- B. Coordinate locations and dimensions of work specified in other Sections that relates to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways and pits.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide KONE Inc; Monospace 500 or a comparable product by one of the following:
 - 1. Otis Worldwide Corporation.
 - 2. Schindler Elevator Corp.
 - 3. ThyssenKrupp Elevator.
- B. Source Limitations: Obtain elevators from single manufacturer.
 - 1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 - 1. Number of Elevators: Eight.

2. Rated Load: 3500 lb.
3. Freight Loading Class for Service Elevator(s): Class A.
4. Rated Speed: 200 fpm.
5. Operation System: Selective-collective automatic operation.
6. Auxiliary Operations:
 - a. Standby power operation.
 - b. Standby-powered lowering.
 - c. Battery-powered automatic evacuation.
 - d. Automatic dispatching of loaded car.
 - e. Nuisance-call cancel.
 - f. Loaded-car bypass.
 - g. Automatic operation of lights and ventilation fans.
7. Security Features: Car-to-lobby feature.
8. Car Enclosures:
 - a. Inside Width: Not less than 80 inches from side wall to side wall.
 - b. Inside Depth: Not less than 65 inches from back wall to front wall (return panels).
 - c. Inside Height: Not less than 93 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/480M, No. 4 finish.
 - e. Car Fixtures: Satin stainless steel, ASTM A480/480M, No. 4 finish.
 - f. Side and Rear Wall Panels: Plastic laminate.
 - g. Door Faces (Interior): Satin stainless steel, ASTM A480/480M, No. 4 finish.
 - h. Door Sills: Aluminum.
 - i. Ceiling: Flat brushed steel finish ceiling with 4 LED Lights.
 - j. Handrails: 1-1/2 inches round satin stainless steel, at sides and rear of car.
 - k. Floor prepared to receive carpet, ceramic tile, or LVT as selected by Interior Designer.
9. Hoistway Entrances:
 - a. Width: 42 inches.
 - b. Height: 84 inches.
 - c. Type: Side sliding.
 - d. Frames: Satin stainless steel, ASTM A480/480M, No. 4 finish.
 - e. Doors: Satin stainless steel, ASTM A480/480M, No. 4 finish.
 - f. Sills: Aluminum.
10. Hall Fixtures: Satin stainless steel, ASTM A480/480M, No. 4 finish.
11. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/480M, No. 4 finish.
 - b. Provide hooks for protective pads in elevator and one complete set of full-height protective pads per elevator.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.

1. Provide regenerative system.
 2. Provide regenerative system that complies with the IgCC.
 3. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
 4. Provide means for absorbing regenerated power when elevator system is operating on standby power.
 5. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- B. Fluid for Hydraulic Buffers: Fire-resistant fluid.
- C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- D. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.
- E. Car Frame and Platform: Bolted- or welded-steel units.
- F. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
- B. Auxiliary Operations:
1. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor above or below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
 3. Nuisance-Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
 4. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
- C. Security features shall not affect emergency firefighters' service.
1. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

2.7 CAR ENCLOSURES

- A. Provide steel-framed car enclosures with nonremovable wall panels, with nonremovable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor:
 - a. Resilient Flooring: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
 - b. Ceramic Tile: Exterior, C-C Plugged grade plywood, not less than 7/8-inch nominal thickness.
 - 2. Floor Finish:
 - a. As selected by Interior Designer.
 - 3. Stainless Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless steel sheet.
 - 4. Fabricate car with recesses and cutouts for signal equipment.
 - 5. Fabricate car door frame integrally with front wall of car.
 - 6. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet.
 - 7. Sight Guards: Provide sight guards on car doors.
 - 8. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 - 9. Light Fixture Efficiency: Not less than 35 lumens/W.
 - 10. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: 1-1/2 hours.

- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Stainless Steel Frames: Formed from stainless steel sheet.
 2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both jambs of hoistway door frames.
 3. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet.
 4. Sight Guards: Provide sight guards on doors matching door edges.
 5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.9 SIGNAL EQUIPMENT

- A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed or semirecessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way live interactive communication system, visual and text-based or audible mode, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
1. Provide manufacturer's standard wall-mounted units.
 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
 3. Provide telephone jack in each unit for firefighters' two-way telephone communication service.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on cars.
- I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above each hoistway entrance at ground floor. Provide units with flat faceplate and with body of unit recessed in wall.
 - 1. Integrate ground-floor hall lanterns with hall position indicators.
- J. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.
- D. Stainless Steel Bars: ASTM A276, Type 304.
- E. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B221, Alloy 6063.
- G. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500 or UNS No. C77600.
- H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications, Type HGP for postformed applications, and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, and pits as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. Place hall lanterns either above or beside each hoistway entrance.
 - 2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and

capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance during normal working hours.
 2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142123.16

SECTION 211300 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The design and installation of a hydraulically calculated automatic system complete and ready for operation for portions of the buildings noted on the architectural code plan. No piping shall be located outside the heated envelope or in the attic unless a dry type system. Laying insulation over piping is not considered within the heated envelope. Balconies, breezeways and other similar locations to be served with dry system or freezeproof heads if constructed properly. Refer to Code Analysis sheets in the Architectural set and the coverage of the roof truss spaces. This shall also be a dry system.

1.2 QUALITY ASSURANCE

- A. **Installer Reliability:** The installer shall possess a valid contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past three years.
- B. **Materials and Equipment:** All equipment and devices shall be of a make and type listed by UL, FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the Engineer.
- C. **Submittals:** Submit as one package. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:
 - 1. **Qualifications**
 - a. Provide a copy of the installing contractor's license.
 - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
 - 2. **Drawings:** Submit scale working drawings conforming to NFPA. Include a site plan showing the piping to the water supply test location.
 - 3. **Manufacturers Data Sheets:** Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
 - 4. **Calculation Sheets:** Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA.
 - 5. **Final Document Submittals:** Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in the specification. Submittals shall include, but not be limited to, the following:

- a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
 - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
 - c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA.
 - d. Certificates shall document all parts of the installation.
 - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA. Recommendations in appendices shall be treated as requirements.
- 1. Perform hydraulic calculations in accordance with NFPA utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
 - 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
 - a. Light Hazard Occupancies: Housing, educational, office, and customary access areas.
 - b. Ordinary Hazard Group 1 Occupancies: Mechanical Equipment Rooms, Electrical Switchgear Rooms, and Electric Closets.
 - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, kitchens, and kitchen storage areas.
 - d. Verify all classifications with NFPA and AHJ.
 - 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
 - 4. Water Supply: Base water supply on a current flow test.
 - 5. Zoning:
 - a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 13, 13R - Installation of Sprinkler Systems
 - 14 – Standpipe Systems
 - 101 - Safety to Life from Fire in Buildings and Structures (Life Safety Code)
 - 170 - Fire Safety Symbols

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory – 2001

D. Factory Mutual Engineering Corporation (FM): Approval Guide

PART 2 - PRODUCTS

2.1 PIPING & FITTINGS

- A. Provide sprinkler systems pipe and fittings in accordance with NFPA and U.L. / F.M. listed for use. Use minimum Schedule 10 black steel with 1 ¼" and above for grooved pipe and Schedule 40 black steel for screwed pipe.
- B. Piping from the exterior main into the building shall be ductile iron with mechanical joints.
- C. CPVC piping per ASTM F442 / F442M, U.L. 1821 may be used only in residential areas where allowed by AHJ, NFPA and manufacturer's listing. Retail/commercial areas shall be black steel. Pipe shall be clearly marked as "listed" and "CPVC sprinkler pipe". Fitting shall be socket type and be U.L. listed and/or FM approved and marked thus. Provide CPVC-to-metal transitions and unions as threaded brass to socket-end.

2.2 VALVES

- A. Valves in accordance with NFPA.
- B. Do not use quarter turn ball valves for (2 inch) or larger drain valves.
- C. Alarm check valve variable pressure type with retarding chamber. Provide basic trimmings for alarm test by-pass, gauges, drain connections, pressure sensitive alarm switch to actuate the fire alarm system.

2.3 FIRE DEPARTMENT SIAMESE CONNECTION

- A. Brass, flush wall type, and a minimum of two (2-1/2 inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Automatic Sprinkler". Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

2.4 SPRINKLERS

- A. Type: Sprinklers shall be UL and/or FM approved. Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval. Provide white escutcheons, semi-recessed type in finished areas.

2.5 SPRINKLER CABINET

- A. Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser.

2.6 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

- A. Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.7 SWITCHES

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Waterflow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.8 GAUGES

- A. Provide gauges as required by NFPA.

2.9 PIPE SUPPORTS

- A. Supports, hangers, etc., of an approved pattern placement to conform to NFPA.

2.10 WALL, FLOOR AND CEILING PLATES

- A. Provide plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings chrome.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situations where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel. To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Welding: Conform to the requirements and recommendations of NFPA.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA.

- E. Supervisory Switches: Provide supervisory switches for sprinkler and standpipe control valves. Do not provide standpipe hose valves and test and drain valves with supervisory switches.
- F. Waterflow Alarm Switches: Install waterflow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA, locate in a secured area, and discharge to the exterior of the building.
- H. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA. Seal this space with a UL Listed through penetration fire stop material in accordance with the specifications. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction.
- I. Provide pressure gauge at each water flow alarm switch location, at the top of each standpipe, and at each main drain connection.
- J. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.

3.2 INSPECTION AND TEST

- A. Preliminary Testing: Hydrostatically test system, including the fire department connections, as specified in NFPA. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA, and when all necessary corrections have been accomplished, advise Architect/Owner to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

END OF SECTION 211300

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 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 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 workstation, shall be the current generation of technology and basic design that has a proven satisfactory service record. 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 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-Owner 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.

1.5 SUBMITTALS

- A. Submit for approval, all 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. Shop drawing review cannot delay project as it is not required to proceed with contracted items.
- 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 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, fan belts, 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 1/2 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.

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.
- 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 22 0500

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, Schuller, Certain/Teed, Dow Chemical, Johns-Manville 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

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.

- 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: Insulation for equipment 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 2: Insulation for 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 need 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.
- 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
Roof Drain – Horizontal	All	2	½”
Dom CW – Garage	All	2	1”
Dom HW – Circulated	All	1	½”

Note: No piping shall be located in attics or other unconditioned areas.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0700

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 1/2" 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.
Gas Above Grade	All	Sch. 40 Blk Steel	Malleable	100 psi/ 1 hr
Gas Below Grade	All	Polyethylene	Fusion	100 psi/1 hr
Refrigerant	All	Copper	Silver solder	400 psi/1hr
Roof Drain	All	Sch. 40 PVC	PVC-DWV	10 ft/1/2 hr

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. Plug Valves

1. Plug valves shall be scheduled as type PLV valves. Valve specifications by type number shall be as follows:
PLV-1 1" valves and smaller Hays 7400 series iron body gas cock, 175 PSI-WOG bronze plug washer and nut, screwed ends.
PLV-2 1-1/4" thru 2-1/2" valves, Rockwell-Nordstrom Fig. 142, semi-steel lubricated plug valve, 175 PSI-WOG coated plug, two bolt cover, short pattern screwed ends. Provide complete with standard pattern cast handle.

G. Valve Schedule

SYSTEM	SIZE	STOP	CHECK	BALANCE
Domestic Water	1/2"-2"	BLV-1	SCV-1	BAV-1
Domestic Water	2 1/2"	BLV-1	SCV-2	BAV-1
Domestic Water	3" & Up	BFV-1	SCV-2	BAV-2
Gas	1" & Below	PLV-1		
Gas	1 1/4" & Up	PLV-2		

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 SUMP PUMP/SEWAGE EJECTOR

- A. Elevator: Zoeller #152 submersible cast iron pump with Oil Smart Ssystem with stainless steel strainer, float control, 1750 rpm sealed motor, permanently lubricated bearings. Unit to have simplex #8112, 8230 tethered float with piggyback cord, adjustable setpoints. Provide 24" Ø by 24" deep sump with split cover. Set cover up off rim ½" with bolts to allow drainage into sump. Pump to provide 50 gpm at 18 ft. head with 1/2 hp 120v motor. Provide with check valve, 2" discharge pipe to exterior.

2.14 DOWNSPOUT NOZZLE

- A. Zurn #ZANB-199 nickel bronze body, threaded inlet, decorative wall flange and nozzle.
- B. Equivalent by Wade, Josam, Smith, Sioux Chief.

2.15 ROOF DRAINS

- A. See drawings.
- B. Equivalent drains by J.R. Smith, Zurn, or Josam.

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 22 1100

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL (Reference Section 220500)

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES AND TRIM

- A. Provide plumbing fixtures as shown on drawings and as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware without pit holes or blemishes and outlines shall be generally true. Architect reserves right to reject any piece, which in his opinion is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fittings shall be chrome plated. All fixtures noted as handicapped or accessible shall meet ADA requirements where installed.
- B. Equivalent fixtures and accessories by following manufacturers will be acceptable.
 - 1. Fixtures: American Standard, Kohler, Gerber, Vortens or Toto.
 - 2. Fittings and Supports: Josam, Smith, Wade or Zurn.
 - 3. Seats: Church, Olsonite or Beneke.
 - 4. Drinking Fountains: Oasis, Halsey Taylor, Haws.
 - 5. Flush Valves: Sloan, Zurn, Delany.
 - 6. Lavatory & Sink Trim: Delta, Chicago Faucet, American Standard, Kohler.
 - 7. Traps, Supplies and Stops: Dearborn, Brass Craft, Central D, Sanitary Dash or as specified under plumbing fixtures. Provide on all fixtures.
 - a. Supplies and Stops: Dearborn Fig. No. 2700 CW 1/2" compression stop and 3/8" O.D. risers in length required. Provide deep chrome plated brass escutcheons. Provide insulation on handicapped accessible hot water.
 - b. Traps: Dearborn #FS510 (1-1/2") and/or EFS507 (1- 1/4") cast brass body with cleanout and 17 gauge tube outlet "P" trap. Provide deep chrome plated brass escutcheon with set screw. Provide pre-fabricated insulation on handicapped accessible fixtures and water coolers.
 - c. Air chambers: Provide individual fixture air chambers, ProFlo Model Hydra-Rester or equivalent.
- C. Plumbing Fixture Schedule: See Drawings.

PART 3 - EXECUTION

3.1 FIXTURES

- A. Set fixtures true and level with all necessary supports for fixtures installed before plastering or grouting is done.
- B. Nipples through wall to fixture connections shall be chrome plated brass. Provide silicone sealer around perimeter of lavatories and urinals at connection to wall. Handicap stalls shall have flush valves set to side with most clearance. Provide vacuum breakers on fixtures having hoses or where hoses can be attached. Provide hammer arrestors on all fixtures.

END OF SECTION 22 4000

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 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. 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-Owner 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.
- E. 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. Shop drawing review cannot delay project as it is not required to proceed with contracted items.
- 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.

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 23 0500

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. Common area systems shall receive total balancing.

END OF SECTION 23 0593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL (Not Applicable)

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, Schuller, Certain/Teed, Dow Chemical, Johns-Manville 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

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.

- 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 or Unconditioned Area:		
Rectangular Supply	2-DEW	1-1/2"
Rectangular Return	1-DIL	1"
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.

- B. Provide insulation materials manufactured by Armstrong, Schuller, Certain/Teed, Dow Chemical, Johns-Manville 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

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.

- 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.
- H. 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.
- I. Insulation materials and application methods (Equipment)
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. 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.
- J. 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 (Not Applicable)

END OF SECTION 23 0700

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 radiation 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., fire-rated where needed. 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/Hoods: Provide Greenheck ESJ-202 extruded aluminum stationary blade louver with extended sill, birdscreen, mill finish. Hoods are to be Greenheck #FGR/FGI. Storm louvers to be Greenheck #AFL-501. 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 23 3100

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 CENTRIFUGAL POWER ROOF/WALL VENTILATOR

- A. Ventilator covers shall be aluminum specifically designed to withstand high wind loads. Wheels 12" in diameter and larger shall have airfoil or medium foil blades. The motor and drive compartment shall be positively externally ventilated. Drive components shall be isolated from the structure. Bearings shall be designed for 200,000 hours operation.
- B. Provide insulated roof curbs sloped where over 1/4" per foot incline.
- C. Provide disconnect switch.

2.2 CENTRIFUGAL POWER IN-LINE EXHAUST FAN

- A. Fans shall be constructed of heavy gauge steel with electro-coated acrylic enamel finish over iron phosphate primer. Bearings shall be pre-lubricated and sealed for minimum maintenance and design for 200,000 hours operation.
- B. Internal parts, wheel, shaft, bearings, motor and drive shall be accessible for inspection, repair or replacement without disturbing inlet or outlet ductwork.
- C. Fans shall be furnished with a mounted safety disconnect. Single phase motors shall have integral overload protection. Provide backdraft dampers, rubber in shear isolators and rods as required to support fans from structure. Performance ratings shall be certified air and sound.

2.3 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.
- 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.

2.4 SIDEWALL MOUNTED PROPELLER FANS

- A. General Description:
 - 1. Fan arrangement shall be exhaust sidewall mounted application, see Fan Schedule.
 - 2. Maximum continuous operating temperature 130 Fahrenheit (54.4 Celsius)
 - 3. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number
- B. Wheel
 - 1. Propeller shall be aluminum blade riveted to steel hub
 - 2. A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft

3. Statically and dynamically balanced in accordance with AMCA Standard 204-05
 4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- C. Motors:
1. Motor enclosures: Totally enclosed fan cooled.
 2. Motors are permanently lubricated, sleeve bearing type on sizes 8-12 and ball bearing type on sizes 14-24 to match with the fan load and furnished at the specific voltage and phase.
 3. Accessible for maintenance.
- D. Drive Frame:
1. Drive frame assemblies and fan panels shall be galvanized steel.
 2. Drive frame shall have welded wire or formed channels and fan panels shall have pre-punched mounting holes, formed flanges and a deep formed one piece inlet venture
- E. Disconnect Switches:
1. NEMA rated: 1
 2. Positive electrical shut-off
 3. Wired from fan motor to junction box
- F. Accessories:
1. Dampers:
 - a. Type: Motorized.
 - b. Prevents outside air from entering back into the building when fan is off
 - c. Balanced for minimal resistance to flow
 - d. Galvanized frames with pre-punched mounting holes
 2. Dampers Guards:
 - a. Guard material: Aluminum.
 - b. Shall completely enclose the damper or wall opening on the discharge side of the fan
 3. Finishes: Types: Permatector.
 4. Wall Housing:
 - a. Mounting arrangement: Flush Exterior.
 - b. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
 - c. Housing shall include OSHA approved motor guard
 5. Wall Collar:
 - a. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
 6. Motor Side Guard:
 - a. Guard type: Standard Guard.
 - b. Protective guard completely enclose the motor and drive side of the fan
 - c. Coated with Permatector, a thermal setting polyester urethane

PART 3 - EXECUTION

- 3.1 Suspend fans in-line on rubber-in-shear isolators and connect ducts with flex duct.
- 3.2 Provide 14" high insulated roof curb and connect ducts with flex duct for roof fans. Route conduits through curb in lieu of roof membrane.

END OF SECTION 23 3400

SECTION 233700 - AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Provide where shown on plans grilles, registers and diffusers. Refer to schedule at the end of this section.

PART 2 - PRODUCTS

2.01 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 or equal.
- E. Schedule – see drawings.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 3700

SECTION 237000 - SPLIT SYSTEMS

PART 1 - GENERAL (Not Applicable)

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. Provide integral unit disconnect.

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 23 7000

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 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. 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-Owner 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. 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 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. Shop drawing review cannot delay project as it is not required to proceed with contracted items.
- 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 26 0500

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. 14 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 insulated 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 26 0519

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 26 0526

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, Racor, 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 26 0533

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 with series rating throughout. Breakers shall be one, two or three pole type as indicated in panel schedule. Provide arc-fault breakers where required by Code.
- 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. Panelboards for apartments shall be Square "D" QO and Square "D" NQOD or equal for all others 400 A and less (common areas).
- H. See panelboard schedules

2.2 DISTRIBUTION PANELBOARDS

A. Bussing Assembly and Temperature Rise

1. Panelboard copper bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. Provide isolated ground bus.

B. Circuit Breakers

1. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front face of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indicated shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required.

C. Integrated Equipment Short Circuit Rating

1. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit rating at the supply voltage and shall be UL listed.

D. Cabinet

1. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Endwalls shall be removable. Fronts shall be of code gauge steel. Gray baked enamel finish electrodeposited over cleaned phosphatized steel.

E. Safety Barriers

1. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

F. Panelboards shall be I-line from Square D or equal.

2.3 SWITCHBOARDS

A. General

1. Utility Metering Compartment: The utility current transformer compartment shall comply with the local utility construction specifications.
2. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit

- current rating of 65K rms symmetrical amperes at 208 VAC maximum.
3. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
 4. Enclosure: Type 1 - General Purpose
 - a. Sections shall be aligned front and rear.
 - b. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
 - c. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
 - d. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
 - e. Top and bottom conduit areas shall be clearly indicated on shop drawings.
 5. Nameplates: Provide 1 inch high x 3 inches engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.
 6. Bus Composition: Shall be plated aluminum. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.
 7. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.
- B. Incoming Main Section Devices
1. Six (6) Service Disconnects
 - a. Incoming conductors shall terminate at lug landing pads.
 - b. All lugs shall be UL Listed to accept solid and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the NEC.
 - c. Provide mechanical type lugs to accommodate the conductor shown on the associated drawings.
 2. Group mounted circuit breakers through 1200A
 - a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
 - b. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
 - c. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.
 - d. Line-side circuit breaker connections are to be jaw type.
 - e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
 - f. Electronic trip molded case full function 100% rated circuit breaker(s) through 1200A
 - g. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, and Instantaneous settings. Each

- adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
 - h. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated [schedule] [drawing].
 - i. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
 - j. Furnish thermal magnetic molded case circuit breakers for 250A frames and below.
 - C. Individually Mounted circuit breakers through 4000A
 - 1. Electronic trip molded/insulated case standard function 80% rated circuit breaker(s) through 2500A
 - a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
 - b. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated [schedule] [drawing].
 - 2. Thermal magnetic molded case circuit breaker(s) through 2500A
 - a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.
 - b. Circuit protective devices shall be Square D molded case circuit breaker(s). Circuit breaker(s) shall have coordinated interrupting capacity. Ampere ratings shall be as shown on the drawings.
- 2.4 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.
- 2.5 EQUIVALENT BY CUTLER HAMMER, ITE, G.E.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 26 2400

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 or equal

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 white 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. 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. Provide in all locations required by Code.
- 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 white 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.

2.4 SWITCHES

- A. Single Pole - Provide specification grade, single pole, 20 amp, 120-277 volt, AC white 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 white 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 white 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 not proceed with the work until unsatisfactory conditions have been 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 26 2726

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 26 2813

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 series rated.
- 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 26 2816

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. Ballasts shall have sound rating indicated on ballast case and rated as follows:

BALLAST TYPE	SOUND RATING
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Pre-Heat - Rapid Start	A
Trigger Start	A
Instant Start	B
High Output	C

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 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, free 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. Fixture 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 26 5100

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 or equal
 2. Hubbell or equal

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.

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. Hand written 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) from 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 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 after the completion of the project if required. 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 27 1000

SECTION 282000 - ELECTRONIC SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.
- B. Refer to all Drawings and Specifications listed in Division 01 for additional requirements.

1.2 SUMMARY

- A. The scope of work for this sub-contract shall include the installation and associated services for a fully operational IP base Video Surveillance System as per manufacturer's guidelines, codes described within this document, that provide central security management, integrated control of the intended site.
- B. IP base video surveillance system shall be installed in the equipment rooms as indicated on the drawings, communicating to the over a local LAN connection. The system shall provide:
 - 1. Provide all required power supplies.
 - 2. Provide all cabling connections required.
 - 3. Provide all specialty conduit requirements.

1.3 RELATED WORK

- A. In addition to work described above, the Work shall include, but not necessarily be limited to, the following:
- B. Equipment identification as indicated on drawings.
- C. Providing all cabling, conduit and connections as required for complete and functional systems.
- D. Providing 120 VAC uninterruptible power as required for all equipment provided under this contract.
- E. Assemble equipment furnished disassembled in accordance with manufacturer's recommendations.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 20 years documented experience, and with a certified servicing organization within 150 miles of Project.
- B. Installer: Company specializing in installing the Products specified in this section with minimum five years documented experience. Experience shall include projects with surveillance systems of similar scope and magnitude. Company shall be a Certified by the product manufacturer.

1.5 MATERIALS AND EQUIPMENT SUBSTITUTION

- A. Material and equipment installed under this contract shall be first class quality, new, unused and without damage. The intent of these specifications is to allow ample opportunity for Contractor to use ingenuity and ability to perform the work to his and Owner's best advantage, and to permit maximum 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.
- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed they are considered an approved manufacturer for the product specified, however; the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. Where other than first named products are used for Contractor base bid proposal it shall be the responsibility of the Contractor to determine prior to bid time that the proposed materials and equipment selections are products of approved manufacturers which meet or exceed the specifications and are acceptable to the Engineer.
- 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 and approval prior to procurement.
- E. Materials and equipment proposed for substitution 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, forward 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.

1.6 DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Contractor shall furnish a minimum of two (2) sets of shop drawings of all materials and equipment. Architect/Engineer will retain one (1) set.
- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, sizes, etc., that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number when item does not appear in specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear equipment manufacturer's name, address and phone number. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. Contractor shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the Architect/Engineer for their review.
- D. All shop drawings submitted to Architect/Engineer shall bear Contractor's approval stamp which shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: telecommunications and electrical characteristics, provisions for supply, and drainage connections to building systems. All shop drawings not meeting contractor's approval shall be returned to supplier for re-submittal.

- E. No shop drawing submittals will be considered for review by the Architect/Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of contractor's review.
- F. Architect/Engineer will not be responsible for or the cost of returning shop drawing submittals that are submitted to them without Contractor's review and approval stamp.
- G. Architect/Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or the representative, nor shall it relieve Contractor of responsibility for error in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be Contractor's responsibility.
- H. Submit with shop drawings of equipment, two (2) sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.
- I. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.
- J. Prepare a complete brochure, covering systems and equipment provided and installed under his contract. shall contain following:
 - 1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
 - 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 system.
- K. Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:
 - 1. Project name and address.
 - 2. Section of work covered by brochure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. LTS. Or approved equal.
- B. Provide High Performance Network Disk Recorder for LTS IP-based video surveillance cameras.

2.2 NETWORK DISK RECORDER

- A. The LTN7732-P16 recorder shall be capable of connecting to up to 32 network cameras without extra license fees and the images can be recorded simultaneously with 16-channel simultaneous playback.
- B. The recorder shall be equipped with 8 TB or storage.
- C. The recorder shall support MPEG-4 and JPEG multi format.

- D. The recorder shall provide Various Recording Mode: Manual, Schedule, Event (Pre/Post), Emergency, and External Timer. It shall have the capabilities to control: Pan/Tilt, Zoom, Focus, Brightness and Preset Positions. It shall be able to search using: Time & Date, Event Type and Camera number.
- E. The recorder shall have up to 8 recording programs including individual recording mode for each camera, and 6 time schedules per day.
- F. The recorder shall have 2x built-in Gigabit network interfaces (10Base-T / 100Base-TX / 1000Base-T) for camera recording and client access.
- G. The recorder shall have the capabilities to transfer recorded images to FTP server upon alarm and/or live image periodically. Images recorded in the SD memory card in the i-Pro network cameras can be transferred to the recorder automatically even when the recorder is in recording status.
- H. The recorder shall be viewable from any properly connected PC using Microsoft Internet Explorer version 6.0 or later
The recorder shall provide user authentication and support different user privileges based on logon ID. From the client the user should (with proper authentication) be able to do the following:
 - 1. Setup cameras
 - 2. Define live viewing, recording rates and quality settings
 - 3. Define recording programs and schedules
 - 4. View live video in either single or quad views
 - 5. Search and playback recorded video
 - 6. Download selected recorded video
 - 7. Control connected PTZ cameras
- I. Supported protocols: TCP/IP protocol, PPPoE, DHCP, DNS, DDNS, NTP, SADP, SMTP, SNMP, NFS, UPnP and iSCSI.
- J. The power source shall be 120VAC, 60Hz at approx. 45W

PART 3 - EXECUTION

3.1 INSTALLATION

- A. System installation shall be in full accordance with the Project Drawings, these Specifications, NFPA Standards, and the manufacturer's published recommendations. All junction boxes shall be painted yellow to indicate closed circuit television system wiring.

All equipment and products furnished shall be UL listed and labeled, and connection shall comply with construction standards.

- B. Grounding shall be provided and connected in strict accordance with manufacturer's installation recommendations.
- C. Protection, Cleaning, and Adjustment
 - 1. Protection from damage and contamination shall be provided for all system components, devices, and equipment during the entire installation and until acceptance testing.
 - 2. Damaged or contaminated devices and/or components shall be replaced before final testing.
 - 3. Final system adjustment shall be provided before final acceptance testing.

3.2 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting controls, focusing cameras, and sensitivities to suit actual occupied conditions. Provide up to three visits at eight hours a piece to the site for this purpose.

3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.
- B. System shall be programmed to function as specified, and a copy shall be made of the initial program and made available to the owner. Coordinate programming with owner.
- C. Any special programming shall be documented, and a written copy made available to the owner.

3.4 TRAINING

- A. Contractor shall provide 4 hours of training to owner.

3.5 WARRANTY

- A. The contractor shall provide a warranty on the physical installation of not less than 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.

END OF SECTION 28 2000

SECTION 283100 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings and as herein specified. Provide annunciation at entrance per FD requirements and central station contact shall be provided.
- B. The complete installation is to conform to the applicable sections of NFPA-72, NFPA 101, Local Code Requirements and National Electrical Code with particular attention to Article 760. Not all devices may be shown on the drawings, but may be needed to meet Code. These are to be included in the contract.
- C. Provide systems by Simplex, Honeywell, Notifier, Gamewell. Bosch, Siemens.

1.2 QUALITY ASSURANCE

- A. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.
- B. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type equipment for at least ten (10) years, and has a local, fully-equipped service organization.
- C. All control equipment shall have transient protection devices to comply with UL864 requirements.
- D. Provide a list of the manufacturers' NICET Certified representatives, (a minimum shall be NICET level III), for all persons who will provide future service, installation coordination, and/or final checkout of the system (including demonstration of proper operation to the (AHJ) authority having jurisdiction, the Architect/Engineer and owner's representative).

1.3 GENERAL

- A. This system shall have Indicating Device Circuits (IDCs), configured as a hardwired, zoned system or an addressable system. An alarm from any zone shall cause all Audible Alarms (audible Notification Appliance Circuits, (NACs)), to sound throughout the building and shall remain in alarm until the audible NACs are silenced, and the Visual Alarms (visual Notification Appliance Circuits, (NACs)), shall flash until the control is completely reset. All auxiliary controlled circuits shall operate and shall remain in operation until the system is completely reset.
- B. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. The system shall use closed loop IDCs with individual circuit supervision, individual NAC supervision, incoming and standby power supervision. Provide all needed equipment to furnish a complete, fully functional system. Include a control panel, manual pull stations, automatic fire detectors, remote control devices, all wiring, conduit, terminations to devices, standard and special wall boxes, junction boxes and cabinets, labor, miscellaneous hardware and furnish all engineering services necessary to make a complete and functioning fire alarm system as hereinafter specified and shown on plans. Any equipment not specifically mentioned in this specification

or not shown on the drawings but required for the operation of the system shall be furnished and installed.

1.4 SYSTEM DESCRIPTION

- A. The system IDCs shall monitor automatic and manual initiating devices, operate all NACs, audio, visual, and cause all auxiliary control devices to operate on any alarm condition. The control panel shall be surface mounted where indicated, shall indicate individual zone(s) in alarm or a trouble condition. Fiber optic cable shall be used for communication between buildings and to clubhouse for interconnection.
- B. To accommodate and facilitate job site changes, the control panel shall provide adequate space to individually configure on-site IDC, NAC, or auxiliary control circuit operation
- C. NACs, audio and visual, shall be circuited as indicated and shall operate throughout the building during any alarm condition. Audio NACs shall sound a temporal code at a minimum of 15 dBA above ambient sound levels. Audio devices shall silence when the "Signal Silence" switch is operated. Visual NACs shall be Xenon flash tubes and shall flash at a synchronized rate. Flash intensity shall be a minimum of 75 Candela On-Axis, and shall meet UL 1971 and ADA requirements. Visual devices shall operate in the alarm condition after the audio devices are silenced, indicating there is still an active alarm present, and shall remain ON until the system is completely reset.
- D. In any alarm condition ALL auxiliary control functions shall operate, shutting down air handling equipment, and the central station DACT, or direct line connection to the local fire department Gamewell systems and campus security. These auxiliary functions shall remain active until the entire system is reset. By-passing of these functions shall be possible, during servicing or testing procedures, through the activation of an auxiliary "By-Pass" switch. This action shall be electrically supervised, causing a "System Trouble" to occur, and this condition shall persist until the by-pass is restored to its "Normal" position.

1.5 SEQUENCE OF OPERATION

- A. Activation of an alarm Initiating Device shall:
 - 1. Cause the display to display the zone or zones in alarm. An alarm log will be generated.
 - 2. Activate the panel tone-alert audible indicator;
 - 3. Cause the audible alarm NACs to sound in a Temporal Code pattern throughout the entire facility until silenced at the main or remote panels.
 - 4. Cause the common Auxiliary Alarm output to activate;
 - 5. Cause the IDC Auxiliary output DACT, or direct connection to activate;
 - 6. Cause the Visual NACs to operate until system is reset.
 - 7. Cause all Auxiliary functions to operate, stop air handling equipment, door holders release, elevator functions, etc.
 - 8. Contact an off-site, constantly supervised, approved authority.
 - 9. Main panels in each building shall send "trouble" signal to Clubhouse upon alarm condition.
- B. Activating the Alarm Acknowledge shall cause:
 - 1. The local panel audible tone-alert to silence;
 - 2. Subsequent alarms shall resound the local panel tone-alert.
- C. Activating the Alarm Silence switch shall:
 - 1. Silence all NACs programmed for on-until-silence;
 - 2. Shall illuminate the dedicated yellow alarm silenced LED.

- D. Activating the Alarm Reset switch shall:
 - 1. Restore the alarm initiating devices to normal;
 - 2. Restore all alarm circuits to their normal condition.
- E. Any Trouble Condition (a single open or a single ground condition), sequence of operation shall:
 - 1. Activate an audible signal;
 - 2. Flash a distinct indication at the yellow trouble LED display, and activate the common trouble output in accordance with the requirements of the applicable codes and standards so that all means of interconnecting equipment, devices, notification appliances and power supplies shall be monitored for the integrity of the interconnecting conductors, or equivalent.
- F. Actuating the Trouble Silence switch shall silence the audible trouble signal.
- G. Supervisory Condition Sequence of operation shall:
 - 1. Be annunciated by flashing the dedicated yellow supervisory LED;
 - 2. Activating the audible tone-alert;
 - 3. Activating the common supervisory output.
 - 4. Indicate the zone number of the IDC in supervisory condition by the red, seven segment fire alarm LED. This seven-segment display shall clearly differentiate between alarm zone numbers and supervisory zone numbers.
- H. Indicator Tests shall:
 - 1. Provide an Indicator Test procedure for manually testing of the local audible tone device, zone alarm and supervisory display, zone trouble display, and individual operator panel LED indicators.

PART 2 - PRODUCTS

2.1 FIRE DETECTION AND CONTROL PANEL

- A. The fire alarm control panel cabinet shall provide the following features:
 - 1. The printed circuit board assemblies of the control panel shall be mounted such that removal of a common, single piece mounting chassis shall provide access for installing the cabinet and for pulling wires into the cabinet.
- B. A label mounted to the inside of the cabinet door shall be clearly visible and contain information for the following:
 - 1. Summarized installation instructions including location of standard, optional, and expansion modules;
 - 2. Operating Instructions to include a readily available list to interpret LED display indications;
 - 3. Summarized programming instructions;
 - 4. A separate label shall be provided to allow on-site documentation of the specific location of the individual IDCs.
- C. The Fire Alarm Control Panel shall contain:
 - 1. Operator interface switches for status acknowledge, alarm silence, and system reset;
 - 2. Discrete indicators to annunciate the following:
 - a. presence of AC power,
 - b. status of alarm silenced,
 - c. presence of supervisory conditions.

- D. The control panel shall have a display that shall automatically scroll to chronologically display the IDC number of all alarm and supervisory conditions. Supervisory conditions shall be clearly differentiated from fire alarm conditions. This display shall be provided to annunciate the following:
 - 1. The zone number of an IDC in Alarm;
 - 2. Annunciate multiple IDCs in Alarm.
 - 3. Indicate the number of an IDC in a supervisory condition.
 - 4. Annunciate multiple IDCs in the supervisory condition.
- E. The control panel shall have a display that shall automatically scroll to chronologically display distinct trouble conditions. Manual operation of the scrolling shall be provided to control the scroll rate. The following trouble conditions shall be capable of being displayed. This display shall display the following:
 - 1. The number of an IDCs in trouble.
 - 2. NAC 1 or NAC 2 trouble;
 - 3. Annunciator interface module trouble;
 - 4. Auxiliary alarm output trouble, indicated by zone;
 - 5. Low battery;
 - 6. Depleted battery;
 - 7. Walk Test system test enabled;
 - 8. Programming trouble;
 - 9. Power supply trouble;
 - 10. Ground fault trouble;
- F. The power supply shall provide up to 4 amps of power to serve detectors, door holders, relays and all alarm notification appliances. In addition to the 4 amps of power for Notification Appliances and Auxiliary equipment, the panel shall provide adequate power to serve the maximum configuration of control panel modules. Provide surge protection on the power supply.
- G. Include a secondary emergency power supply with capacity for operating system in standby mode for 60 hours followed by alarm mode for 5 minutes. The control panel shall obtain its primary operating power from a 120 VAC, 60 Hz supply.
- H. A "Depleted Battery" warning shall be sounded in the event that operation on battery back-up exceeds the capacity requirements of the stand-by batteries. Operation shall include activation of the audible tone-alert and a unique indication shall be displayed on the operator control panel.
- I. Active Status Reminder shall: When any Alarm, Supervisory, or Trouble condition be present within the system and the audible signal silenced, the local tone alert shall resound every 8 hours (each change of work shift) to act as a reminder that the fire alarm system is not 100% operational.

2.2 PERIPHERAL DEVICES

- A. Provide Double Action Pull Stations (Manual Fire Alarm Boxes). They shall be manufactured from high impact red Lexan or aluminum, with raised and painted white lettering reading "FIRE, PULL HANDLE DOWN". The front of the station is to be hinged to a backplate assembly and will mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations will be double action and located as indicated on the prints. Mount on a standard 4" square flush back box, with single gang trim ring. These boxes and trim rings shall be furnished by this contractor.

- B. Provide Alarm Horn/Strobe combination units as indicated. The horns shall be electronic, non-contact type, optical controlled diaphragm vibrating units, polarized and shall be operated by 24VDC. Each horn assembly shall include separate wire terminal for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted. The following type visual units (described in the next paragraph), shall be incorporated as part of the horn unit where indicated. The alarm horn/strobe units shall be suitable for mounting on a standard 4" square back box with a standard extension with trim ring. Finish shall be high impact, flame retardant PC/ABS thermoplastic red housings, having "FIRE" lettering on the face of each unit. Mounting, stand alone or with Xenon strobe units, shall be on a standard 4" square back box, with a minimum depth of 2 5/8" and a double gang trim ring. Standalone horns such as in apartment units shall be low frequency type. The 75 dB at the pillow shall be achieved by the system. This may mean adding devices not shown.
- C. Visual indicating appliances (Xenon Strobes) shall be comprised of a Xenon flashtube, be entirely solid state and have shock-mounting arrangement to resist bulb failure due to vibration. These devices shall be UL listed and be capable of either ceiling or wall mounting. The polycarbonate lens shall be pyramidal in shape, having a multi-surface reflector used to provide symmetrical light output in key axis directions, visible from a 180 field of view. The front panel or bezel which is constructed of UL Listed Noryl, may be inverted so that the lens, normally to the side of the audio device, can be mounted below the audible device. Visual units shall be of the stand-alone type or be incorporated as part of the horn or speaker units. Units shall provide 4 wire connection to insure properly supervised in/out system connection. Visual indicating appliances shall flash with 110 Candela intensity in all shops and production areas, 30 Candela intensity offices and other finished areas. 30 Candela intensity shall be tested per UL 1971 for 75 Candela on-axis. Visual signaling devices shall provide intensity so that the viewer can discern when they have been illuminated, in ALL building areas when in alarm regardless of the viewer's orientation.
- D. Provide photo electric smoke detectors, operating on light scatter principle, 24V DC two wire operation, complete with photo conductive cells, lamp (light emitting diode for light source) and self-compensating circuitry to provide maximum stability against effects of aging, dust and film accumulation. Detectors shall be factory set to detect smoke at a nominal 2.2% light obscuration per foot regardless of rate of combustion. Each detector shall be equipped with pilot light to indicate that the detector is in alarm condition and facilities for remote LED operation. For ease of installation and maintenance, detectors shall be designed for twist lock mounting on a separate base assembly, having screw terminals for external connections. Detector shall include a built-in micro fine screen (30 mesh - 900 hexagonal holes per square inch) to prevent entry of dust or insects. In addition, detectors shall incorporate "easy clean" chamber design which allows smoke chamber to be cleaned by simply removing twist-off smoke cover (smoke detectors that require major disassembly for cleaning not acceptable). Mount on 4" octagonal box.
- E. Duct detector housings shall be solid state, extrusion formed Lexan plastic construction, including mounting flanges and shall be capable of direct duct mounting. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Sampling tubes shall be installed with the housing in place, and tubes shall be removable while the housing is in place, for servicing and testing operations. Housings shall have an alarm and power on LEDs, both visible through the front cover of the housing. Photoelectric Detectors, mounted within these housings shall be as specified above, and these detectors shall also obtain their operating power from the supervised current in the fire alarm loop. Each housing shall incorporate a matching detector baffle, which, along with the correct

length sampling and return tubes shall direct smoke through the detector. Installation must comply with NFPA-90A. Housings shall have remote LED outputs. Mount remote alarm test and indicator L.E.D.s as shown. These units shall be mounted on single gang box located on the ceiling below each Air Handling Unit.

- F. Automatic heat detectors shall be fixed- temperature type. When the fixed-temperature portion is activated, the units shall be non-restorable and give visual evidence of such operation. Heat detectors shall be 200 degree F, fixed temperature.
- G. Auxiliary relays shall be 24V DC operation, SPDT contacts rated at 10 Amperes each and shall contain an enclosure for mounting. Relays shall contain an LED indicator, which shall light when the unit is activated.
- H. Door Holders shall be semi-flush type magnetic devices. Submittal shall have type used for each door.

2.3 FIRE ALARM WIRE AND CABLE

- A. Fire alarm wiring for this system shall be per Section 16110, meeting these minimum requirements:
 - 1. All wire and cable shall be in strict compliance with local codes and the provisions of NEC Article 760 A and C for Power-limited Fire Protective Signaling Circuits;
 - 2. Shall be color coded throughout with the same color for same circuits from source to final termination;
 - 3. Shall be free from opens, grounds and shorts between conductors;
 - 4. All single strand wiring shall have a minimum isolation rating of 600 volts;
 - 5. Shall be in a completely separate conduit system;

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The control equipment shall be grounded with an approved ground wire.
- B. Job Site Responsibilities:
 - 1. By Equipment Supplier:
 - 2. Technical installation support via On-job-site visits by sales and service staff, each being NICET certified, in the Field and sub field Number 00303, Fire Alarm Systems, with a Minimum, Level III certification;
 - 3. Power-up and complete system check out by our Technical Representative;
 - 4. Final letter of completion with detailed inspection report conforming to the NFPA 72 format and guidelines, signed by a NICET, Field and Subfield 00303, Fire Alarm Systems, level III certified person employed by the equipment supplier;
 - 5. Provide equipment operational training session(s), adequate to provide the customer proper operating information which will allow them to properly respond to Alarm and Trouble conditions without assistance from the equipment supplier. This training shall be videotaped, with a first-class copy provided to the customer for their future use in on-going training of employees;
 - 6. Provide all warranty repair of all equipment provided by manufacturer.

- C. Electrical Contractors Responsibilities:
1. Provide enough skilled supervision and labor to complete the project on schedule;
 2. Review and understand the submittal, drawings, and other instructions provided by the manufacture;
 3. Pull wire and mount panels and peripheral devices in accordance with specifications and code;
 4. Test all circuits for continuity with an OHM Meter, troubleshoot ground faults, shorts, and opens, and terminate all wires in peripheral devices and control panels using provided wiring diagrams;
 5. Follow procedures defined by Supplier to protect equipment from damage during construction or installation;
 6. Energize system only in presence of equipment supplier technical personnel;
 7. Provide as built wiring diagrams to the General Contractor the completion of the project.
- D. Testing: The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.
- E. Operating and Service Manuals
At the completion of the project, and at least 14 days in advance of request for final inspection, contractor shall provide two volumes of manuals containing the following:
1. "Operating Instructions" for all items of equipment including start-up and shut-down procedures;
 2. "Service and Lubrication Instructions" for each unit of equipment, including spare parts list indicating local source of supply;
 3. Record shop drawings and catalog cuts marked to reflect "as-built" conditions;
 4. Each complete set of manuals shall be bound in a three-ring, loose-leaf, hard-back binder.
- F. Warranty: The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 28 3100

SECTION 284000 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.
- B. Refer to all Drawings and Specifications listed in Division 01 for additional requirements.

1.2 SUMMARY

- A. The scope of work for this sub-contract shall include the installation and associated services for a fully operational IP base Access Control System as per manufacturer's guidelines, codes described within this document, that provide central security management, integrated control of the intended site.
- B. IP base access control system shall be installed in the equipment rooms as indicated on the drawings, communicating to the over a local LAN connection. The system shall provide:
 - 1. Provide all required power supplies.
 - 2. Provide all cabling connections required.
 - 3. Provide all specialty conduit requirements.

1.3 RELATED WORK

- A. In addition to work described above, the Work shall include, but not necessarily be limited to, the following:
- B. Equipment identification as indicated on drawings.
- C. Providing all cabling, conduit and connections as required for complete and functional systems.
- D. Providing 120 VAC uninterruptible power as required for all equipment provided under this contract.
- E. Assemble equipment furnished disassembled in accordance with manufacturer's recommendations.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience, and with a certified servicing organization within 150 miles of Project.
- B. Installer: Company specializing in installing the Products specified in this section with minimum five years documented experience. Experience shall include projects with surveillance systems of similar scope and magnitude. Company shall be a Certified by the product manufacturer.

1.5 MATERIALS AND EQUIPMENT SUBSTITUTION

- A. Material and equipment installed under this contract shall be first class quality, new, unused and without damage. The intent of these specifications is to allow ample opportunity for Contractor to use ingenuity and ability to perform the work to his and Owner's best advantage, and to permit maximum 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.

- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed they are considered an approved manufacturer for the product specified, however; the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. Where other than first named products are used for Contractor base bid proposal it shall be the responsibility of the Contractor to determine prior to bid time that the proposed materials and equipment selections are products of approved manufacturers which meet or exceed the specifications and are acceptable to the Engineer.
- 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 and approval prior to procurement.
- E. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.
- F. Materials and equipment proposed for substitution 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, forward 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.
- G. Within 10 working days after bids are received, apparent low bidder shall submit to A/E for approval three copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 3 working days after award of contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work for Architect/Engineer's review. Where 30 working day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certifications that order was placed within 30 working day limit.

1.6 DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Contractor shall furnish a minimum of two (2) sets of shop drawings of all materials and equipment. Architect/Engineer will retain one (1) set.
- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, sizes, etc., that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number when item does not appear in specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear equipment manufacturer's name, address and phone number. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

- C. Contractor shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the Architect/Engineer for their review.
- D. All shop drawings submitted to Architect/Engineer shall bear Contractor's approval stamp which shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: telecommunications and electrical characteristics, provisions for supply, and drainage connections to building systems. All shop drawings not meeting contractor's approval shall be returned to supplier for re-submittal.
- E. No shop drawing submittals will be considered for review by the Architect/Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of contractor's review.
- F. Architect/Engineer will not be responsible for or the cost of returning shop drawing submittals that are submitted to them without Contractor's review and approval stamp.
- G. Architect/Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or the representative, nor shall it relieve Contractor of responsibility for error in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be Contractor's responsibility.
- H. Submit with shop drawings of equipment, two (2) sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.
- I. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.
- J. Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:
 - 1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
 - 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 system.
- K. Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:
 - 1. Project name and address.
 - 2. Section of work covered by brochure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

The Security Management System (SMS) shall be the Kantech EntraPass Corporate Edition. Or approved equal.

2.2 DESCRIPTION

The Security Management System (SMS) shall be an integrated system that utilizes a Sybase embedded SQL database for the storage and manipulation of related data. The SMS shall include a server with applications software, multi-site gateways for communication between the server and controllers, operator and administrator workstations with appropriate software, hard copy printers and secure backup media. The security field devices (readers, door position switches, REX, etc.) shall communicate with the field panels via a dedicated cable network. The field panels shall communicate to the server via a Fast Ethernet 10/100, TCP/IP network, RS 232/RS 485 connection, or dial-up modem.

The SMS shall allow for growth and scalability from a smaller system to a larger, high-end, or enterprise system. The SMS shall be modular in nature, allowing system capacities to be easily expanded without requiring major changes to system operation. All defined system data as well as historical information shall be maintained. Customizable user interfaces shall allow management of system information and activity for administrators and operators. The response time between the moment when a card is presented at the reader and when the door is unlocked shall not exceed one second. The SMS shall include a badging solution with a GUI for badge design. No extra licensing shall be required for the badging solution.

The SMS shall be able to connect to authenticated non-SSL or non-authenticated email server for all email features described. The SMS shall be able to connect to SMTP or POP3 authenticated email server.

The SMS shall support up to:

20	Workstations
4	Concurrent WebStations
20	Redundant servers
Unlimited	Digital video recorders
41	Multi-site gateways
17,408	Door controllers per Multi-site gateway
69,632	Card readers and/or keypads and/or elevator cabs of 64 floors each per Multi-site gateway
Unlimited	Access cards
Unlimited	Card families or site codes
4,456,448	Monitored points per Multi-site gateway
4,456,448	Control relays per Multi-site gateway
2	Simultaneous user languages

2.3 PERFORMANCE - MONITORING

A. Monitoring Mode

1. The SMS shall enable every operator to customize his/her desktop configuration. It shall be possible to modify the desktop appearance and to create up to eight desktops and to associate up to ten different display screens to each. It shall be possible to modify the size and position of all screens. It shall be possible to determine if these screens shall be floating anywhere on the desktop or fixed on the desktop. If the workstation is equipped with a dual output video card and two or more monitors, it shall be possible to distribute the screen to multiple monitors. However, each screen shall be able to be viewed alone or together depending on

operator needs. Once these parameters are saved, the configuration shall automatically take effect whenever the operator logs in.

For all types of screens, it shall be possible to access the general properties of the screen by simply right clicking at the center of the screen. From there it shall allow for linkage between associated screens without having to exit the current screen or section. It shall be possible to right click events on the desktop for editing which shall bring the user directly to the card, door, or component window and back.

2. Message Screen

All events that occur shall appear in real time. The text shall include at least the date, time, and a pertinent description of the event as well as its condition. The display of this screen shall be customizable and a different background and message color can be used for every type of event.

All component modification events shall be tagged with addition (+), modification (=) or deletion (-) tag. Every in-coming event shall be documented by one or more icons representing video images, photos, access card, server, gateway, controller, card reader, and relay or supervision point. It shall be possible to classify the events on the screen by sequence, date and time, type of event, or type of message. In addition, a text filter shall be available to facilitate searching. It shall be possible to access the last up to 100,000 transactions from this window without the need to request a special report.

It shall be possible to right click on an event and perform edit or other functions linked to the event.

3. Card Holder Photo Screen

When a card is presented to a card reader, the software shall automatically display the photograph of the cardholder in this window. From this screen it shall be possible to select the cardholder's name, card number, event text, and comments as well as specify a door or group of doors for which the operator would like to display a photo. The SMS shall support the display of up to 4 pictures simultaneously. Furthermore the SMS shall allow that each picture box be assigned to a specific door for additional filtering

4. Filtered Message Screen

This screen shall be a copy of the text messages screen except it shall be possible to select a specific message filter. The SMS shall include a choice of pre-configured filters and the ability to create customized filters. For every new filter it shall be possible to associate a name to it, select the type of event, select door, select workstation, select gateway, select supervision input, and select output.

5. Alarm Screen

Alarms that require an acknowledgement by an operator shall be displayed on this screen in text form only. The text shall include at least the date, time and description of the alarm, and its condition. It shall be possible to classify events on the screen by sequence, date and time, type of event, or type of message. A text filter shall be available in order to facilitate the search.

If instructions about an alarm are envisaged, they shall automatically appear in a second window on the screen. If a graphic is associated with the alarm, it shall appear automatically on the screen defined to this effect. The icon associated to the control point shall be represented and show the actual state of the point.

The operator shall be able to access a log book in order to document the alarm that occurred. Once this information is recorded in the log it shall not be erasable or modifiable.

Operators shall also be able to see previous comments or system logs added this event.

Operators shall be able to run a report of the alarms from this window.

It shall be possible to associate video call-up with an alarm. When this occurs, the main screen shall become the video screen, not the alarm screen.

6. Video Screen (Video View)

When the SMS is integrated with American Dynamics digital video recorders, it shall be possible to view the video images of cameras associated with them. The SMS shall enable the creation of an unlimited number of video views, each one associated with up to 16 different cameras or graphics. . It shall be possible for the operator to see at a minimum 48 cameras simultaneously using three video views per screen. It shall be possible for an operator to edit or modify an existing view or create a new one directly from this screen. For each video view it shall be possible to select sequential, mosaic pattern, or preset viewing modes.

It shall be possible for an operator to access all the commands of a motion PTZ camera to include rotate on its axis, adjust its focus, and have a larger view of the image. Accessibility to camera images and commands shall be limited by operator security level.

No additional licensing shall be required to perform this function.

7. Historical Message Screen

This screen shall allow operators to choose from a previously created custom report. Operators shall choose a start/end date/time. The report will be populated in this window and have the same characteristics of the message screen including all right click functions.

The historical message screen shall allow operators to add comments to any event this can be later seen and reviewed.

B. Graphics Screen

1. There are three options for graphics that appear as background on the screen. The first is a reproduction of the building(s) floor by floor. The graphic module shall be capable of importing files in BMP, EMF, WMF, JPEG, GIF, PCX, PNG, TIF, or PCD formats.
2. The second option is using web pages, or WebViews, as background on the screen. This can be used in the following manners:
 - a. Accessing to DVR web servers
 - b. Embedding default web pages into operator desktops
 - c. Adding an IP camera onto a video view
 - d. Embedding intranet pages or directories into the operator environment
 - e. Adding PDF, Word documents, etc. to the desktop
 - f. Accessing to network cameras from the WebStation
 - g. HTML or PDF pop-up instruction on alarm
 - h. Integrating report folders in the desktop for quick access
3. The third option is to assign a live video view as background on the screen if video integration is being utilized.
4. For all three options, control points shall be represented by a descriptive icon. Control points include workstations, gateways, controllers, card readers, doors equipped with either card readers or supervision contacts, cameras, relays, and input monitoring points such as motion sensors. The icons shall be animated, meaning they shall represent the state of the point to which they are associated in real time. Every graphic shall support at least 100 control points.

Right clicking on an icon shall directly access the manual commands of each control point. A door shall be capable of but not limited to temporarily unlocking, manually unlocking or locking, and enabling or disabling a reader. A supervision point shall be capable of being enabled or disabled. A control relay shall be capable of being activated, deactivated, or temporarily activated. Cameras shall be capable of viewing images or live video.

No additional licensing shall be required to perform this function.

C. Communication Methods

1. The SMS shall ensure the communication to remote sites over a LAN or WAN/Internet using a dedicated communication server device, Kantech IP Link or the KT-400 controller. This shall only be applicable with the use of Multi-site Gateways. It shall ensure secure communications by the use of 128-bit AES Encryption. It shall reduce bandwidth consumption by managing the communication protocol of Kantech controllers at the remote site. Polling of Kantech controllers shall be done by the Kantech IP Link or KT-400 in the field and not over the network. The Kantech IP Link or KT-400 shall provide support for up to 32 door controllers. The Kantech IP Link or KT-400 shall be configured from the access software or from a web page which has the security feature of being disabled after successful use.
2. For sites that do not have network links, communication to remote sites shall be ensured by Dial-up modems. This shall only be applicable with the use of Multi-site Gateways. The SMS shall support up to 32 such modems that can simultaneously communicate and transmit or receive data from remote sites. No modem shall be dedicated to specific sites; communication shall be established such that the first site calling shall have access to the first available modem, and so on.
3. Each Multi-site Gateway should be able to control 32 local controller loops by using the RS-232/RS-485 protocols via serial or USB port. In addition, each Multi-site Gateway should be able to control up to 512 Ethernet loops using TCP or UDP protocols, via the use of the Kantech IP Link, or KT-400 of 32 controllers each.
4. In all communication methods, the door controller shall retain in their memory all necessary data for controlling doors that they supervise. In case of communication failure, the door controller shall execute all its functions normally.

2.4 PERFORMANCE – PROGRAMMING & CONFIGURATION

A. User Section

1. This section shall include all functions involved in the issuance of an access or ID card as well as database search and importation tools. During the addition or modification of a card, information about the card shall be sent to the door controllers affected by these new parameters as soon as the operator accepts the addition or modification. An additional command requiring a reloading of the cards database in the door controllers shall not be acceptable.
2. The SMS shall enable the creation and definition of a user access card. There can be up to five cards per user and users can be managed by cardholder name or card number. When creating user cards, the operator shall be able to select a card format directly from a Card dialog and enter the card number as it is printed on the card.
3. The following user information shall be able to be saved in the user section:
 - a. 5 Card numbers each with their own expiration date, trace and lost or stolen statuses.
 - b. First and last name
 - c. Card type
 - d. Additional information (10 fields)
 - e. Start date
 - f. Expiry date
 - g. Personal ID number (PIN)
 - h. State of the card
 - i. Multi-swipe activation
 - j. Comments

In addition, it shall be possible to associate a photograph, signature, and badge template to a card. The picture of the card holder shall always be visible when the profile is active on the screen.

4. The SMS shall allow for the creation of an unlimited number of card templates to be used as ID cards. Template parameters include name, number of sides, and size. It shall be possible to directly print a template on an access card. The operator shall be able to design customized badging templates directly from the access management software. No specific badging program or software other than the latter and no additional licensing shall be required for this function. Any workstation shall be capable of creating ID cards based on operator security level. The following items shall be capable of being added to and modified on a badge template:
 - a. All information fields associated to a cardholder
 - b. Bar code
 - c. Text zone
 - d. Start date, expiry date, today's date
 - e. Saved images and logos
 - f. Borders
 - g. Rectangles (including rounded rectangles, ellipse)
 - h. Lines and arrows
 - i. Photograph (can be cropped)
 - j. A background
5. The SMS shall allow for the creation of a day pass to be issued to visitors for a single day. The SMS shall also have the ability to create temporary ID visitor cards.

The SMS shall offer the possibility of modifying the parameters of a group of cards simultaneously based on Card Type. The system shall enable the creation of an unlimited number of card types. The following fields shall be modifiable:

 - a. Card status (valid, invalid, lost, stolen)
 - b. Card monitored (yes, no)
 - c. Start date (schedule)
 - d. End date (schedule)
 - e. Delete after expiration (yes, no)
 - f. Wait on keypad (yes, no)
 - g. Access group (selection menu)
 - h. Template model (selection menu)
6. The operator shall be able to search for a card by last or first name, card creation date, card number, or any of the ten fields of user definable information. The system shall display the last card transactions, namely the latest sixteen denied access events, authorized events, database events, and/or time & attendance events.
7. The operator shall be able to quickly view the cardholder's door list
 - a. Operators shall be able to export the door access list.
 - b. A detailed view of the door's schedule shall be show when selecting a door.
8. The operator shall have the option of expanding the comments field in the user section for better viewing.
9. The SMS shall enable the creation of an unlimited number of Import/Export models, give them a name, select required fields, select their layout, and determine the filed delimiter. This shall allow for acceleration of the data entry process by importing databases from a spreadsheet.
10. The SMS shall allow for 250 access levels programmed per loop/site of controllers. Every card shall be assigned an access level which shall determine where and when the access card will be valid. When the system consists of several sites or gateways, it shall be possible to use batch programming of access levels.

11. The SMS shall allow for creation of tenant lists that can be imported in the (Kantech Telephone Entry System) KTES units. The lists shall be easy to fill up and allow for up to 3000 tenants in each list. The SMS shall support the creation of unlimited amounts of tenant lists.
 12. The SMS shall allow of importing and exporting of tenant lists. The operator shall have the ability to choose which fields to import and export.
 13. The following tenant information shall be able to be saved for each tenant.
 - a. Tenant name
 - b. Tenant ID (customizable in length per tenant list)
 - c. Primary Telephone Number
 - d. Secondary Telephone number
 - e. Tenant PIN (customizable in length per tenant list)
 - f. Pin access schedule
 - g. Tenant level
 - h. Tenant language
 - i. Card number
 - j. Disable card trace
 - k. Start/End date
 - l. No disturb schedule
 - m. Prioritized tenant in the display list
 - n. Call second phone number option schedule
 - i. Ability to call the second phone number only (does not call primary) during valid schedule
 14. The SMS shall allow for a card number to be assigned to specific tenant. The KTES unit will be able to send the card number to other controllers of a Wiegand protocol.
 15. The SMS shall allow for an unlimited amount of Card Types. Cards types shall be used to group cards together for ease of management. Card types shall have the option of being assigned a card access group template. Card access groups shall be copied to the card holder profile to give the card holder's access levels.
 16. The SMS shall provide the possibility to perform card batch operations. The mass card modifications shall take effect in real time. Each batch operation shall allow for mass cards to be changed based on their card type. The batch card modification shall be able to change:
 - a. Card State
 - b. Supervisor level
 - c. Card count value
 - d. Card Tracing
 - e. Start Date
 - f. End Date
 - g. With deletion on expiration
 - h. Waiting for keypad
 - i. Card access group
 - j. Replacing access levels
 - k. Updating access levels
 - l. Adding new access levels
 - m. Updating and adding new access levels
 - n. Card Badge layout
- B. Video Section
1. The SMS shall be capable of being combined with up to 300 American Dynamics Intellex digital video recorders and American Dynamics Hybrid DVR (HDVR), American Dynamics

TVR2 and American Dynamics Video Edge NVR v4.00. From any of the workstations it shall be possible to do the following:

- a. View one or more camera images from different sources
- b. Query the history of each recorder and view images saved on disk
- c. View, modify, or delete programming parameters of a recorder
- d. Control the movement of all motion cameras directly with the workstation mouse of the SMS (PTZ control)
- e. Export camera images to hard disk and video vault (capable of exporting multiple formats, password protected to protect chain of evidence)
2. The SMS shall ensure the time management and synchronization for all digital video recorders. It shall be possible to determine the time refresh frequency on the network. The SMS shall allow for configuration of each digital video recorder. For each recorder it shall be possible to:
 - a. Assign a name
 - b. Determine the recorder type
 - c. Determine the network IP address or domain name (DNS)
 - d. Manually configure the video, communication and event ports
 - e. Determine the number of cameras
 - f. Determine the query frequency
 - g. Determine the number of failed queries required before a loss of communication message is displayed on the screen
 - h. Import camera details from existing video servers
3. The SMS shall define the programming parameters for every camera connected to a digital video recorder. For each camera it shall be possible to:
 - a. Assign a name
 - b. Determine the type of camera
 - c. Assign a representative icon for identification on a graphic screen
 - d. Determine if the camera image can be visible on a video view
 - e. Determine the type of recording
 - f. Determine which events from the recorder should display an alarm message on the screen
 - g. Determine the number of pre-selections desired
 - h. Determine the number of patterns desired
 - i. Add comments to record in the video vault
4. The SMS shall allow for the creation of an unlimited number of video views. For each video view it shall be possible to connect up to 16 cameras from various sources.
5. The SMS shall be able to incorporate on the same view multiple cameras from different American Dynamics Intellex DVRs or graphics. Furthermore on different video views the SMS shall be able to incorporate multiple cameras source from different American Dynamics HDVR or graphics. In addition on different video views the SMS shall be able to incorporate multiple cameras source from different American Dynamics TVR2 or graphics. In addition on different video views the SMS shall be able to incorporate multiple cameras source from different American Dynamics Video Edge NVR or graphics
6. The video view programming parameters make it possible to:
 - a. Assign a name
 - b. Determine the view size
 - c. Determine the refresh rate of the image
 - d. Determine whether to show metrics
 - e. Determine whether to show camera controls
 - f. Determine whether to show overlays
 - g. Determine whether to auto-hide text

- h. Determine whether to activate image zoom
 - i. Determine whether to activate video sequence
 - j. Determine delay before sequence launch
 - k. Determine camera display delay
 - l. Determine display pre-selection delay
 - m. Determine pattern display delay
 - n. Determine graphic display delay
 - o. Determine display mode (1x1, 2x2, 3x3 and 4x4).
 - p. Incorporate up to 16 cameras from various sources or 16 graphics
7. The SMS shall be able to trigger, from one or more specific events, the start of a recording on a recorder with one or more cameras connected to it. The SMS shall allow for the creation of an unlimited number of video triggers. The SMS shall allow for the creation of an unlimited number of recording parameters. For each recording parameter it shall be possible to:
 - a. Define a name
 - b. Select the digital video recorder to which this recording parameter refers
 - c. Select the camera to which this recording parameter refers
 - d. Associate a pre-selection or size
 - e. Determine the start recording trigger
 - f. Determine the pre-alarm time
 - g. Determine the total recording time
 - h. Determine the stop recording trigger
 8. It shall be possible for a video event on one digital video recorder to trigger an action on another digital video recorder.
 9. The SMS shall allow the playback of all recordings stored on the hard drive of any of the digital video recorders. The operator shall be able to save the video into the video vault.
 10. The SMS shall provide the operator access to the complete list of normal and abnormal events that required the activation of video recording. The sequence of images can be saved to a hard drive for subsequent consultation and shall be encrypted. The SMS shall allow the operator to access a complete list of alarm recordings in progress including origin of the alarm. The SMS shall be capable of displaying a list of exported videos.
 11. It shall be possible to view recorded video tagged to an Access or Video event by quick linking from the Message desktop.
 12. The SMS shall be capable of connecting 128 American Dynamics DVR/NVR with no additional options needed.
 13. The SMS shall allow increasing the number of American Dynamic DVR/NVR in groups of 128 by the use of option codes. The SMS shall support unlimited connections.
 14. The SMS shall allow for installation of remote modular video managers. The remote video managers shall be available only after the first 128 connections have been reached,
- C. Definition Section
1. The SMS shall allow the creation of 100 schedules per loop/site of controllers and an unlimited number of system schedules. Each schedule can include up to 4 intervals. A schedule can be associated with a supervision point, a relay, an access level, a door, elevator floor, an operator, or an event. The SMS shall allow time zone management.
 2. With a Multi-Site Gateway, specific schedules which include up to 20 intervals shall be available for the KT-400. The KT-400 shall keep all 20 intervals in memory when in standalone mode.
 3. The SMS shall allow the creation of 366 holidays. It shall be possible to define a name, define a date, and determine the type. The SMS shall allow the operator to view all the holidays defined in holiday type and sites by viewing them all in a yearly calendar.

4. The SMS graphics shall enable operators to view the exact location of a component installed at the site, or the state of components and peripherals represented in the graphic such as doors, contacts, motion sensors, controllers, and cameras. The SMS shall allow for the creation of an unlimited number of graphics. The components on the graphics represented by icons as well as the graphics themselves shall have the ability to be modified. The SMS shall allow for printing of the graphics with their respective components on the graphical floor plan.
 5. The SMS shall allow the management of 2,048 elevator cabs of 64 floors each for each gateway. It shall be possible to associate a schedule to the call button. Outside of the schedule, a valid card for a particular floor will have to be presented to the cab reader for it to be activated. The floor selection button group associated with the card's access level will become operational for a predefined duration and all other buttons shall become inactive. The SMS shall allow the creation of groups of floors and access levels.
 6. The SMS shall provide the possibility to setup unlimited amount of tasks via the user friendly task builder. The operator shall be able to create emails templates that can incorporate variable to dynamically populate the emails. Using the command GUI menu, the operator can program commands for any component in the SMS. Commands such as but not limited to lock, unlock, temporary unlock, toggle, back to schedule for the doors, relays, inputs and enable and disable readers. The operator can also program commands for specific card count. The commands should be able to accept specific components or variables that can filled dynamically.
 7. The SMS shall provide the possibility to setup unlimited batch card operations via the user friendly task builder. The mass card modifications shall take effect in real time. Each mass card modifications task shall allow for mass cards to be changed based on their card type. The mass card modification task shall be able to change:
 - a. Card State
 - b. Supervisor level
 - c. Card count value
 - d. Card Tracing
 - e. Start Date
 - f. End Date
 - i. With deletion on expiration
 - g. Waiting for keypad
 - h. Card access group
 - i. Replacing access levels
 - ii. Updating access levels
 - iii. Adding new access levels
 - iv. Updating and adding new access levels
 - i. Card Badge layout
 8. The SMS shall provide the possibility to assign the tasks previously created to be triggered on specific components and specific events.
 9. The SmartLink Task Commander shall process the command from the first available SmartLink application on the SMS.
 - a. The use of a specific SmartLink to run the SmartLink Task Commander shall not be accepted. The SMS shall accept many SmartLinks to be installed thus providing a redundant SmartLink for all SmartLink Task Commander tasks.
- D. Devices Section
1. The physical components of the SMS including workstations, Multi-site gateways, gateway, site, controllers, Kantech Telephone Entry System (KTES), doors, relays, and monitored inputs shall be individually configured and defined. Individual sites shall also be defined.

- The software shall allow the use of a controller Express Setup feature in order to minimize the time needed for controller definition.
2. Each component in the Devices Section shall allow for a comment section per component. The SMS shall allow for unlimited amount of characters in the comment section.
- E. Alarm Interface
1. The SMS shall interface with any external alarm system thereby arming or disarming the system by presenting a valid card to an entry / exit door. It also shall be possible to associate a keypad with a reader forcing the cardholder to enter a number in the keypad after presenting a card. This integration shall only be possible with the use of a Multi-site gateway. It shall be possible at a minimum to:
 - Set a monitored input as an arming button
 - a. Associate a usage schedule with an arming button
 - b. Set the exit and entry delay
 - c. Determine whether the system must wait for a valid access to arm
 - d. Determine whether the system must wait for a valid access card swipe and appropriate pin number to disarm. Determine whether the door must relock on arming request
 - e. Associate a monitored input with an alarm panel condition
 - f. Lock a door unlocked by a schedule when armed
- F. Intrusion Integration
1. The SMS shall allow interface with the DSC PowerSeries PC1616, PC1832, PC1864 and MaxSys 4020 series alarm panels intrusion panel thereby eliminating hardwired integration between the SMS controllers and the DSC PowerSeries® intrusion panel. The DSC PowerSeries® intrusion panel shall communicate with the Multi-site gateway via rs-232 or directly to a KT-400 controller. The SMS shall allow for:
 - a. Single / multiple partition arming and disarming via reader
 - i. Disarm via card only or forced valid card and pin
 - b. Single / multiple partition arming and disarming via operator commands
 - c. Receive events from intrusion panel
 - d. Receive partition names, user codes and zone names programming.
 - e. Update user codes
 - f. Assign user codes to cardholders
 - g. Viewing a fully functional virtual keypad to perform all functions available on the DSC PowerSeries® or the MaxSys 4020 intrusion panel keypad
 - h. With the MaxSys 4020 integration the SMS shall be able to control the PGM outputs from a graphic screen
- G. System Section
1. The SMS shall define the profile of a system operator based on name, password, language, privileges, login schedule, security level, workspaces, and password expiry date. The SMS shall provide the possibility to force the operators to assign a mandatory card type to the users. The operator shall be able to provide a default card type for every card.
 2. The SMS shall determine access rights granted to an operator based on security levels. There shall be three predefined access levels called Installer, Administrator, and Guard. The SMS shall have the ability to create an unlimited number of security levels that can be assigned to one or more operators. It shall be possible to determine from which system components the operator shall be authorized to receive events and take action. It shall be possible to specify for each programming window if the operator can (any combination):
 - a. View the component in read only
 - b. Add new components
 - c. Modify existing components (cannot add new)

- d. Delete components
 - e. Save as
 - f. Print components
 - g. View links
3. The SMS shall allow System Administrators to grant or deny operators access to all system physical components such as gateways, sites, controllers, doors, relays, inputs, access levels, reports, schedules, tenant lists, video servers, card types, etc. using Workspaces. This allows greater ease for larger sites to locate and assign components that pertain to specific gateways and sites. System administrators shall be able to tailor specific system applications and workstations Workspaces, therefore restricting access to information to all levels of operators. Operators shall be able to use temporary workspaces to narrow their fields of view when accomplishing specific tasks, and then easily revert back to their main workspace.
 4. The SMS shall allow for the creation of unlimited instructions. These instructions shall be attributed to one or more events that will be used in documenting the event and guide the operator on duty in performing tasks. It shall be possible to edit the instructions in two different languages.
 5. The SMS shall make it possible to customize system events. All events shall be pre-defined to display on all system workstations. For each event it shall be possible to:
 - a. Determine a display schedule
 - b. Determine a color
 - c. Assign a printer
 - d. Associate one or more workstations
 - e. Associate an instruction
 - f. Associate a schedule for an acknowledgement request
 - g. Determine the priority level
- H. Report Section
1. The SMS shall include templates for various types of reports to include the following:
 - a. Card use reports
 - b. Manual operations reports
 - c. Alarm reports
 - d. Historical reports
 - e. Time & Attendance reports
 - f. Detailed reports
 - g. Summary reports
 - h. Statistical reports
 - i. Roll Call Reports
 2. The SMS shall allow for the creation of custom reports based on any event or component in the system. The SMS shall support an unlimited amount of customized reports.
 3. All reports shall be able to be displayed on screen, printed, or sent by e-mail on a daily, weekly, or monthly basis. All event reports can be automated to be generated and sent at a specific time for a specific time period.
 4. The SMS shall support at a minimum the following report formats: Sybase, Dbase IV, CSV, XLS, PDF, RTF, and TXT.
 5. The SMS shall be able to generate an access report in CSV with all the card information associated to that access event.
 6. All component modification events shall be tagged with addition (+), modification (=) or deletion (-) tag. In all event driven reports the operator shall have the choice to specify a tag or all tags in order to further filter report.

7. The system shall support for the creation of custom Time and Attendance reports. Each time and attendance report shall support up to 32 rules for masking the entry and exit times of each card. Also each report shall support a "First entry and last exit" feature.
 8. Time and attendance reports shall have the possibility to compile the report in using fractions base (percentage) or actual hours and minute base.
 9. The SMS shall allow the creation of custom Roll Call reports, which can without operator intervention be emailed to multiple people and/or printed on multiple printers. The Roll Call report shall be a system wide feature.
 10. Each report quick report, historical report and time attendance report shall have a priority number assigned to it. When multiple reports are requested. The SMS shall prioritize the creation of the report based on their priority number. From the Report queue management window the operator shall have the possibility to promote the report to a higher priority. The operator shall also have the ability to request more processing power form the computer in order to expedite the report creation.
 11. Reports shall be prioritized from queue of 1 to 99. When the report is requested as priority 1 it shall be processed first. The default value for all new reports shall be set to 50. Operators shall be able to change it as needed.
- I. Help Section
1. The SMS shall have contextual help button every window. The operators shall also have option of pressing F1 on their keyboard and Help window will appear with the correct section of the item they were looking at in the SMS
 2. The SMS shall include an About window which shall include basic information about the SMS. It shall also include the KAP start/end date and tokens needed. The operator shall be able to send KAP details via email to a pre-defined email list by the click of one button.
 3. In addition the About Window shall include contact information for the SMS manufacturer and contact information for the installation company/dealer. The dealer information shall at a minimum but not limited to:
 - a. Company name
 - b. Address
 - c. Website link
 - d. Email link
- J. Options Section
1. The SMS shall allow operators to access basic server and display functions and allow the operator to determine default settings for the server hard drive. The operator shall also be able to determine the time to perform a server backup, programmable on monthly, weekly, or daily basis. It shall be possible to schedule and plan mass automatic KT-400 firmware updates.
 2. The SMS shall allow for the servicing company to enter their contact information for the SMS operator's disposal.
- K. System Status Section
1. The SMS shall allow operators to view the state of various access system components in text or numerical form. A specific controller's state shall also be able to be viewed in graphic form via the picture of the controller with the status of each terminal. Workstation and database status shall also be able to be displayed.
- L. Various Tools
1. The SMS shall employ an Express Setup to configure system components such as sites and controllers, as well as peripherals associated to these components such as ports and inputs. This utility will reduce the programming time to a minimum.

2. The SMS shall employ a database utility to allow the re-indexation and verification of archived files and verify the integrity of indexes, links, and database arborescence.
3. The KT-Finder tool shall help troubleshoot the Kantech IP Link and KT-400 on site or remotely. It can also be used as an alternate method of configuration for both.
4. The SMS shall include a vocabulary editor to be used in designing custom language dictionaries.

M. Video Vault

1. Video Vault is an optional remote networked application used to automate recovery of video data from the digital video recorders and save it on a disk for long term video storage and retrieval. The information can be stored on an independent system or within the server. The footage that shall be tagged and recoverable from the digital video recorders shall include SMS triggers, manual triggers, and saved video server footage.
2. For the archived video files it shall be possible to:
 - a. Assign a folder name to index the archived files
 - b. Create sub folders based on day of the week, day, week, month of the year, month, video server name, camera name and/or event description name.
 - c. Determine the hard drive to store the recovered videos
 - d. Determine the composition of the name of the saved file
 - e. Determine the format of the saved video
 - f. Assign a frame from the saved video to represent as a saved file
 - g. Determine the number of simultaneous downloads
 - h. Determine a size limit for recoverable videos
 - i. Assign a password to videos stored
 - j. Determine a delay between requests to the server
3. There shall be scheduled transfers for archiving thereby reducing video network traffic during peak times.

2.5 PERFORMANCE – WEBSTATION

A. WebStation

1. WebStation is an optional tool that will allow for performing certain functions from a remote location to be used with the regular SMS system via Web Browser. The WebStation provides card management to guards, secretaries, or managers without the need to deploy a full workstation. A concurrent connection option shall provide access to a pre-determined number of users.
2. The WebStation shall have the ability to be viewed in multiple languages. Each WebStation shall come in English and French. Customer languages can be created using an easy to use tool. The WebStation shall automatically detect the Web Browser's preferred language.
3. The Webstation shall at a minimum be supported by Internet Explorer 6-7-8, Mozilla Firefox 3.6, Google Chrome 6.0 and Safari 5.0.
4. The following functions are available using WebStation:
 - a. Card management (including 5 cards per username)
 - b. Live card holder picture capture using camera
 - c. Live signature capture using signature pad
 - d. Viewing the card's last transactions
 - e. Exporting in CSV format the card list with all the card information
 - i. Search for specific cards to export
 - f. Forgot Password & Reset password
 - g. Create, modify and delete access levels
 - h. Create, modify and delete schedules
 - i. Assigning access levels

- j. Performing door operation
- k. Performing relay operation
- l. Performing input operation
- m. Performing elevator operations
- n. Requesting historical reports via email
- o. Viewing live events using menu or quick launch viewer
 - i. Export events in CSV or Excel XML format
 - ii. Customize the view of the events to have the newest event on top
 - iii. Filter events using message filters
 - iv. Search for events using text filters
- p. Using WebViews

2.6 INTEGRATION

A. SmartLink

1. The SmartLink application offers the ability to send messages to pagers and cell phones and through the use of e-mail. SmartLink provided instant e-mail notification of alarm events and the ability to e-mail reports.
2. Integration with other systems can also be done through the SmartLink API. This tool is used for advanced integration with third party applications like visitor management software, human resources systems, time and attendance systems, video systems, HVAC, etc.

B. Card Gateway

1. The Card Gateway is an optional external interface that shall allow the client to make modifications to the system card database through an Oracle or MS-SQL database. The application may be installed and run on the server's CPU. It shall allow for HR software integration and enable operators to modify, add, or obtain information on cards in real time.

2.7 REDUNDANCY & MIRRORING

A. Redundant Server

1. The SMS shall be able to support an optional redundant server whose main function shall be to monitor the primary server and ensure automatic (Hot Standby) take over if necessary. The redundant server shall have all the same characteristics and functions as the primary server.
2. The transition between these servers shall be completely transparent. When the primary server is operational once more, it shall be capable of synchronizing its database automatically with the redundant server and then resume absolute control of the access management system. No human intervention shall be required in this operation.
3. The operator shall be able to perform any and all operations during a fail-over synchronization between the primary server and redundant server.
4. The system shall support the use of multiple simultaneous redundant servers. The need to install third party (not EntraPass) licensing shall not be acceptable.

2.8 OPERATION

The SMS shall perform the following tasks:

1. Allow card access management for one or more buildings.
2. Control access to various doors equipped with a card reader. Allow the ability to set card use count options to limit the number of times a card can be used.

3. Allow automatic transfer of cards to an unknown area by a push of a button for emergency exit purposes.
4. Monitor all defined alarm points as well as all doors controlled by card readers based on programmed schedules.
5. Send transactions for which printing is required to one or more printers, based on a set schedule.
6. Access the system using the main and secondary menus (to which access is limited by a password) to make additions and required changes to various data files so that they can be updated by the user without the manufacturer's assistance.
7. Enable the entry of access code data for every card or group of cards.
8. Seamlessly connect to onsite alarm systems.
9. Fully functional virtual keypad with DSC® PowerSeries PC1616, PC1832 and PC1864 alarm system in addition with the DSC MaxSys 4020 alarm panel. The operator shall perform all functions available on a standard keypad with the PowerSeries or MaxSys 4020 series alarm systems. The operator shall be able to use the computer keyboard or the mouse to perform actions on the virtual keypad.
10. Associate to each event a recording schedule for each destination (hard drive, monitor).
11. Automatically display all alarms on screen in text with optional graphic or picture and trigger a sound requiring an acknowledgement on the keyboard to stop the alarm.
12. Alarm pop-ups can be sent to many workstations. An alarm pop-up shall be acknowledged once by one operator.
13. Mandatory comments can be added by the operator when acknowledging the alarm pop-up.
14. In the case of an unacknowledged alarm within a customizable time; the alarm shall be sent to all active operators with additional log information.
15. Each event should print on a log printer. For security reasons, each event shall be incremented with a print number. Numbering shall start from 0 every day.
16. Generate reports and view them on the screen, output them to a printer, or send them to an email address.
17. Supervise based on programmed schedules of specific points such as door contacts, volumetric detectors, mechanical points, high and low temperature sensors, or any other equipment necessary for good building management.
18. View and/or save video images.
19. When integrated into a digital video recording system (American Dynamics), allow the management of the recordings of all the cameras via access system workstations.
When connected to a digital video recording system (American Dynamics), allow the orientation of all PTZ cameras directly using the workstation mouse of the access system.
20. The SMS shall offer the option to create 4 digit, 5 digit or 6 digit PIN for the card holders.
21. The PIN length shall be defined SMS wide.
22. When connected to a digital video recording system (American Dynamics), allow the recovery and storage of selected videos to an independent server.
23. Save the database manually or automatically backup following a schedule.
24. Uninterrupted backups. The operator shall be able to perform any task during a SMS backup.
25. The operator shall be able to perform any and all operations during a fail-over synchronization between the primary server and redundant server.
26. The SMS shall remind SMS operators via email and messages (pop-ups) of the SMS KAP status. The SMS shall have pre-defined reminders set to:
 - a. 60 days before KAP expiration
 - b. 30 days before KAP expiration
 - c. Day of KAP expiration
 - d. 30 days after KAP expiration

27. The SMS KAP reminder shall include but not be limited to SMS serial number tokens needed and SMS Edition.
28. When the access control system manages parking lot entry and exit, it shall be possible to set a maximum number of vehicles authorized to simultaneously access the parking area. Once the parking lot is full, the system shall prevent access to any cardholder for as long as a parking space has not become available.
29. Allow for a Dual Custody option to add extra security to a door by requesting that two card holders must access the door together.
30. It shall be possible to program on KT-400 controller readers a double and triple switch function:
 - a. It shall be possible to have activate the multi-swipe function a predetermined schedule
 - b. The double and triple swipes shall be able to be activated on reader simultaneously each with their respective actions.
 - c. The multi-swipe function shall be able to but not limited to:
 - i. Toggle door unlock
 - ii. Unlock door
 - iii. Relock door
 - iv. Temporarily unlock door
 - v. Activate Relay
 - vi. Temporarily activate relay
 - vii. Arm door partition request when using a Multi-Site gateway
31. Each card holder shall have the option of having the multi-swipe function active.
32. A specific event shall be generated for any valid or invalid, double or triple swipes.
33. Save events on a hard drive according to required criteria.
34. Perform the following operations from all workstations:
 - a. Lock or unlock, one time unlock, return to schedule one door or a group of doors.
 - b. Temporarily unlock a door using a custom timer for additional door unlocking on KT-400 controller doors
 - c. Disable and enable readers
 - d. View custom programmed comments in the component's Operation section.
 - e. Activate or deactivate a relay or a group of relays.
 - f. Activate or deactivate the recording of one camera or a group of cameras.
 - g. Activate or deactivate a point or a group of points.
 - h. Program or modify one card or a group of cards.
 - i. Validate or invalidate one card or a group of cards.
 - j. Change time and date.
 - k. Demand the system state in text or graphic mode.
 - l. Query, create and/or modify data on: Access levels, Schedules and holidays, Access card, Instructions, Reports and log, Doors, Supervision points and relays, Operator levels, and Graphics.
 - m. Ability to use an easy to use system tree view to select the components.
 - n. View which cards are in the roll call sectors.
 - o. View the card's last known access in the roll call sector.
35. Perform the following operations from the SmartLink Task Commander:
 - a. Alarm
 - b. Disable and enable any reader.
 - c. Lock, unlock, temporary unlock return to schedule, disable enable any elevator and elevator floor.
 - d. Activate, deactivate, temporary activate, toggle and return to schedule of any relay.

- e. Shunt, unshunt, temporary shunt, toggle, return to schedule and continuous supervision of any input.
- f. Set count usage, manually overwrite the count, disable count usage, decrement count usage, increment count usage for all the cards.
- g. Send alarm emails.
- h. The use of variables in the SmartLink Task Commander can be used instead of hard coded values.
- i. Mass card modifications on without operator intervention.
- j. Ability to use generically created commands to perform task on different components.
- k. Each specific card shall have the ability to activate a specific component in the above mentioned states without the need to create hard coded the commands.
- l. The SmartLink Task Commander shall process the commands on the first available SmartLink on the SMS.
 - i. The use of a specific SmartLink to run a specific SmartLink Task Commander shall not be accepted.
 - ii. The SMS all allow for many SmartLinks to be installed without the need to purchase additional option codes.
 - iii. The SmartLink Task Commander shall be run from any of the available SmartLink.
 - iv. The Smartlink Task commander shall allow for single or grouping of components of the same type to trigger the same task. The need to have a specific trigger programmed per component to trigger the same task shall not be accepted.

2.9 EQUIPMENT

A. Server and Redundant Server Requirements

The SMS server and redundant server shall meet the following minimum requirements:

- 1. The server shall have a Dual core processor or better
 - a. If doing video the server shall have an Intel Core 2 Quad core processor or better
- 2. The server shall have a 500-watt power unit
- 3. The server shall have 2 GB RAM.
- 4. The server shall have 20 GB hard disk drive space.
 - a. If doing video the server shall have 30 GB with video server more more
- 5. The server shall have a 48x CD-ROM drive
- 6. The server operating system shall be Windows XP Pro 32- bit. Windows 2003 Standard and Enterprise Server Edition/ Vista Enterprise, / Windows 2008 Server/Windows 7. All OS's shall be 32-bit or 64-bit.
- 7. The server shall have a 10/100/1000 Base-T network adapter
- 8. The server shall have a high quality multilingual keyboard
- 9. The server shall have a two button ergonomic mouse
- 10. The server shall have an On-Off switch
- 11. The server shall have an appropriate UPS

B. Multi-Site Gateway Requirements

The SMS Multi-Site gateway shall meet the following minimum requirements:

- 1. The Multi-Site gateway shall have an Dual core processor or better
- 2. The Multi-Site gateway shall have a 500-watt power unit
- 3. The Multi-Site gateway shall have 2 GB RAM.
- 4. The Multi-Site gateway shall have 20 GB hard disk drive space.
- 5. The Multi-Site gateway shall have a 48x CD-ROM drive

6. The server operating system shall be Windows XP Pro 32- bit. Windows 2003 Standard and Enterprise Server Edition/ Vista Enterprise, / Windows 2008 Server/Windows 7. All OS's shall be 32-bit or 64-bit.
 7. Multi-Site. The Multi-Site gateway shall have a 10/100/1000 Base-T network adapter
 8. The Multi-Site gateway shall have a high quality multilingual keyboard
 9. The Multi-Site gateway shall have a two button ergonomic mouse
 10. The Multi-Site gateway shall have an On-Off switch
 11. The Multi-Site gateway shall have an appropriate UPS
- C. Workstation Requirements
- The SMS workstations shall meet the following minimum requirements:
1. The workstation shall have a Dual core processor or better
 2. The workstation shall have a 500-watt power unit
 3. The workstation shall have 2 GB RAM.
 4. The workstation shall have 20 GB hard disk drive space.
 5. The workstation shall have a 48x CD-ROM drive
 6. The server operating system shall be Windows XP Pro 32- bit. Windows 2003 Standard and Enterprise Server Edition/ Vista Enterprise, / Windows 2008 Server/Windows 7. All OS's shall be 32-bit or 64-bit.
 7. The workstation shall have a 10/100/1000 Base-T network adapter
 8. The workstation shall have a high quality multilingual keyboard
 9. The workstation shall have a two button ergonomic mouse
 10. The workstation shall have an On-Off switch
 11. The workstation shall have an appropriate UPS
- D. Controllers
- The SMS shall support the following door controllers:
1. Kantech KT-400
 2. The KT-400 is an Ethernet-ready four door controller with sixteen monitored points, on-board door strike power, sixteen reader outputs, four relay outputs, and auxiliary power output. It shall accept Wiegand, proximity, ABA clock and data, bar code, magnetic, integrated keypad, and smart card reader types. It shall also support FIPS 201 cards, with and without checking the expiration date. It supports RS-232, RS-485 and 128-bit AES Encrypted Ethernet 10/100Base-T communication. It supports expansion modules to provide 256 inputs and 256 outputs. It shall support 136 double end of line inputs. It shall support up to support 8 card formats (9 with DUAL ioProx driver). The KT-400 shall support native 20 intervals per schedule.
 3. Kantech KT-300
The KT-300 is a two door controller with eight monitored points on board expandable to sixteen, door strike power, auxiliary power output, and two auxiliary outputs. It shall accept Wiegand, proximity, bar code, magnetic and integrated keypad reader types. It supports RS-232, RS-485, and Combus communication. It supports relay, input, and output expansion modules. The KT-300 is available in 128k and 512k memory versions.
 4. Kantech KT-100
The KT-100 is a one door controller with four monitored points, door strike power, and four auxiliary outputs. It shall accept Wiegand, proximity, bar code, magnetic and integrated keypad reader types. It supports RS-485 communication.
 5. Kantech KT-200 (Legacy)
- E. KTES (Kantech Telephone Entry System)

1. The KTES enables tenants to grant access to the building, to their visitors, via their own telephone line or cellular telephone. The KTES supports 250 tenants with the option of supporting up to 3000 tenants. The KTES also includes:
 - a. 4 lines x 20 characters LCD module with controllable LED backlighting
 - b. Programming menus available in three (3) languages (English, French and Spanish)
 - c. Built-in RS-485
 - d. 128-bit AES encrypted Ethernet
 - e. Internal modem
 - f. Three (3) relays
 - g. Microphone
 - h. Speaker
 - i. Backup battery
2. Optional KTES accessories are:
 - a. Heater kit
 - b. Postal lock
 - c. Color camera
 - d. Goose neck mounting
 - e. Paper index (flush mounted)
3. The KTES shall be programmed via the keypad and LCD for stand alone mode or via the SMS.
4. The unit shall support a Wiegand reader that will allow tenants to wipe their cards and enter the building.
5. The KTES shall employ flashable firmware with auto update.
- F. Card and Reader Support
 1. The SMS shall support configuration of unlimited card formats.
 2. The SMS shall support up to 2 card formats per KT-100 and KT-300 controller (3 with DUAL ioProx driver).
 3. The SMS shall support up to 8 card formats per KT-400 controller (9 with DUAL ioProx driver).
 4. The SMS shall support readers that provide Wiegand signaling and magnetic ABA signaling to include:
 - a. Kantech ioProx family of readers
 - b. Wiegand swipe readers
 - c. Proximity readers
 - d. Biometric readers
 - e. Smart card readers
 - f. Wireless readers
 - g. Magnetic readers

PART 3 - EXECUTION

3.1 INSTALLATION

- A. System installation shall be in full accordance with the Project Drawings, these Specifications, NFPA Standards, and the manufacturer's published recommendations. All junction boxes shall be painted green to indicate closed circuit television system wiring.
- B. All equipment and products furnished shall be UL listed and labeled, and connection shall comply with construction standards.

- C. Grounding shall be provided and connected in strict accordance with manufacturer's installation recommendations.
- D. Protection, Cleaning, and Adjustment
 - 1. Protection from damage and contamination shall be provided for all system components, devices, and equipment during the entire installation and until acceptance testing.
 - 2. Damaged or contaminated devices and/or components shall be replaced before final testing.
 - 3. Final system adjustment shall be provided before final acceptance testing.

3.2 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting controls, focusing cameras, and sensitivities to suit actual occupied conditions. Provide up to three visits at eight hours a piece to the site for this purpose.

3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.
- B. System shall be programmed to function as specified, and a copy shall be made of the initial program and made available to the owner.
- C. Any special programming shall be documented and a written copy made available to the owner.

3.4 WARRANTY

- A. The contractor shall provide a warranty on the physical installation of not less than 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.

3.5 TESTING

- A. The software shall be entered into the SMS computer systems and debugged. The Contractor shall be responsible for documenting and entering the initial database into the system. The Contractor shall provide the necessary blank forms with instructions to fill-in all the required data information that will make up the database. The database shall then be reviewed by the Contractor and entered into the system. Prior to full operation, a complete demonstration of the computer real-time functions shall be performed. A printed validation log shall be provided as proof of operation for each software application package. In addition, a point utilization report shall be furnished listing each point, the associated programs utilizing that point as an input or output and the programs which that point initiates.
- B. Upon satisfactory on-line operation of the system software, the entire installation including all subsystems shall be inspected. The Contractor shall perform all tests, furnish all test equipment and consumable supplies necessary and perform any work as required to establish performance levels for the system in accordance with the specifications. Each device shall be tested as a working component of the completed system. All system controls shall be inspected for proper operation and response.

- C. Tests shall demonstrate the response time and display format of each different type of input sensor and output control device. Response time shall be measured with the system functioning at full capacity. Computer operation shall be tested with the complete data file.
- D. The Contractor shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built documentation.

3.6 TRAINING

The Contractor shall provide a competent trainer who has extensive experience on the installed systems and in delivering training to provide the instruction. As an alternate, the Contractor may propose the use of factory training personnel and coordinate the number of personnel to be trained.

3.7 MAINTENANCE

- 1. The Contractor shall offer a Kantech Advantage Program (KAP) to provide twelve additional months of free software updates and online training for the end user.
- 2. Technical support is available at no charge to all Kantech dealers whether or not they have a KAP activated for the systems they are supporting.

END OF SECTION 28 4000

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.

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. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
2. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of termite control product.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and 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.

D. Sample Warranties: For special warranties.

1.5 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 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. Products: Subject to compliance with requirements, provide the following or approved equal:
 - a. Bayer Environmental Science; Premise 75.
 2. 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 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). 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. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 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: Under ground-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. Crawlspace: 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.

3.4 PROTECTION

- A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 313116

SECTION 321316 - DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Colored concrete paving.
2. Stenciled concrete paving.
3. Stained concrete paving.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.

1.2 DEFINITIONS

- A. Cementitious Materials:** Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio:** The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and decorative concrete paving construction practices.
2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Ready-mix concrete manufacturer.
 - c. Decorative concrete paving Installer.
 - d. Manufacturer's representative of decorative concrete paving system.

1.4 ACTION SUBMITTALS

- A. Product Data:** For each type of product.
- B. Samples:** For each type of exposed color, pattern, or texture indicated.
- C. Design Mixtures:** For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent.
 - 8. Joint fillers.
- C. Material Test Reports: For each of the following:
 - 1. Aggregates.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
 - 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less. Do not use notched and bent forms.
- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
- C. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.
- D. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

- E. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, gray portland cement Type I/II.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4-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: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 3. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
- E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bon Tool Co.
 - b. Brickform; a division of Solomon Colors.
 - c. Butterfield Color, Inc.
 - d. Dynamic Color Solutions, Inc.
 - e. Euclid Chemical Company (The); an RPM company.
 - f. Matcrete Inc.
 - g. Scofield, a Business Unit of Sika Corporation.
 - h. Solomon Colors Inc.
 - i. Venator Materials PLC.
- F. Water: Potable and complying with ASTM C94/C94M.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber, Monofilament Fibers: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. FORTA Corporation.
 - c. Nycon Corporation.
 - d. Propex Operating Company, LLC.
 - e. Sika Corporation.
- B. Synthetic Fiber, Fibrillated Fibers: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. FORTA Corporation.
 - c. Nycon Corporation.
 - d. Propex Operating Company, LLC.
 - e. Sika Corporation.

2.6 SURFACE COLORING MATERIALS

- A. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bomanite Co.
 - b. Bon Tool Co.
 - c. Brickform; a division of Solomon Colors.
 - d. Butterfield Color, Inc.
 - e. Dynamic Color Solutions, Inc.
 - f. Euclid Chemical Company (The); an RPM company.
 - g. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
 - h. Laticrete International, Inc.
 - i. Master Builders Solutions.
 - j. Scofield, a Business Unit of Sika Corporation.
 - k. Specialty Concrete Products, Inc.
- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation that facilitates release of stamp mats and texture rollers.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Bon Tool Co.
- b. Brickform; a division of Solomon Colors.
- c. Butterfield Color, Inc.
- d. Matcrete Inc.
- e. Scofield, a Business Unit of Sika Corporation.
- f. Specialty Concrete Products, Inc.

2.7 STAMPING DEVICES

- A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Bomanite Co.
 - b. Brickform; a division of Solomon Colors.
 - c. Scofield, a Business Unit of Sika Corporation.
 - d. Specialty Concrete Products, Inc.
- B. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Matcrete Inc.
 - b. Scofield, a Business Unit of Sika Corporation.
 - c. SuperStone, Inc.
- C. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Bon Tool Co.
- D. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Artcrete, Inc.
 - b. Bon Tool Co.
 - c. Butterfield Color, Inc.
 - d. Proline Concrete Tools, Inc.

2.8 STAIN MATERIALS

- A. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AmeriPolish.
 - b. Americrete, Inc.
 - c. Bomanite Co.
 - d. Bon Tool Co.
 - e. Brickform; a division of Solomon Colors.
 - f. Butterfield Color, Inc.
 - g. Duckback Products.
 - h. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
 - i. Scofield, a Business Unit of Sika Corporation.

2.9 CURING AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bon Tool Co.
 - b. Brickform; a division of Solomon Colors.
 - c. Dayton Superior Corporation.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Laticrete International, Inc.
 - f. Master Builders Solutions.
 - g. Nox-Crete Products Group.
 - h. Sika Corporation.
 - i. W. R. Meadows, Inc.
- B. Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, nondissipating, non-yellowing, manufactured for use with colored concrete.
1. Curing compound shall be pigmented type matching color of integrally colored concrete and shall be approved by coloring admixture manufacturer.
 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dayton Superior Corporation.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Laticrete International, Inc.
 - d. Master Builders Solutions.
 - e. Nox-Crete Products Group.
 - f. W. R. Meadows, Inc.

- C. High-Solids, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, non-yellowing, manufactured for use with colored concrete.
1. Curing compound shall be pigmented type matching color of integrally colored concrete and shall be approved by coloring admixture manufacturer.
 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dayton Superior Corporation.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Laticrete International, Inc.
 - d. Master Builders Solutions.
 - e. Nox-Crete Products Group.
 - f. V-Seal Concrete Sealers & Specialty Coatings.
 - g. W. R. Meadows, Inc.

2.10 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Polyethylene Film: ASTM D4397, 1 mil thick, clear.

2.11 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
- 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 40 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content:
 - a. 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing 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.

- F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- H. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.
 - 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 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
 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 will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from centers of dowels.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- D. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- E. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- F. Screed paving surface with a straightedge and strike off.
- G. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.

- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.8 INTEGRALLY COLORED CONCRETE FINISH

- A. Integrally Colored Concrete Finish: After final floating, apply the following finish:
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.9 STAMPING

- A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.
 - 1. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft.
 - 2. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft.
 - 3. After application of release agent, accurately align and place stamp mats in sequence.
 - 4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
 - 5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
- B. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.
 - 1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 - 2. Accurately align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
 - 3. Carefully remove polyethylene film immediately after tool stamping.
- C. Roller Stamping: After floating and while concrete is plastic, apply roller-stamped finish.
 - 1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 - 2. Accurately align roller and perform rolling operation to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp surfaces inaccessible to roller.
 - 3. Carefully remove polyethylene film immediately after roller stamping.

3.10 PIGMENTED MINERAL DRY-SHAKE HARDENER APPLICATION

- A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:

1. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
 2. After final power floating, apply the following finish:
 - a. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
- B. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft.

3.11 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Compound: Apply immediately after final finishing. 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.
 1. Cure integrally colored concrete with a pigmented curing compound.
 2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

3.12 STAINING

- A. Newly placed concrete paving shall be at least 14 days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
 1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
 - a. Do not use acidic solutions to clean surfaces.
 2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.

3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
 4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between 7 and 8.
- C. Scoring: Score decorative jointing in paving surfaces 1/16 inch deep with diamond blades to match pattern indicated. Rinse until water is clear. Score after staining.
1. Joint Width: 3/8 inch.
- D. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
- E. Penetrating Stain: Apply to paving surfaces according to manufacturer's written instructions and as follows:
1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
 2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

3.13 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
 4. Lateral Alignment and Spacing of Dowels: 1 inch.
 5. Vertical Alignment of Dowels: 1/4 inch.
 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 7. Joint Spacing: 3 inches.
 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 9. Joint Width: Plus 1/8 inch, no minus.

3.14 REPAIR AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316

SECTION 321813 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes synthetic grass surfacing.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for preparation, compaction, and grading of granular base.

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: For synthetic grass surfacing.
 - 1. Include sections and details.
 - 2. Show locations of seams and method of seaming.
- C. Samples: For each type of synthetic grass surfacing indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each synthetic grass surfacing assembly.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, 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. Turf Fabric: Minimum of 300 sq. ft. for each type indicated.
 - 2. Infill: Minimum of two bags of each type.
 - 3. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
 - 4. One new set of maintenance tools, of type recommended by synthetic grass surfacing manufacturer for installation.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration and excessive wear.
 - b. Deterioration from UV light.
 - c. Excessive loss of shock attenuation.
 - d. Seam separation.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Turf Fabric: Turf fabric tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.
 - 1. Tuft Bind: Not less than 8 lbf according to ASTM D1335.
 - 2. Breaking Strength: Minimum 200 lbf in warp direction and minimum 200 lbf perpendicular to warp direction, according to ASTM D5034.
- B. Synthetic Grass Surfacing: Assembly tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.
- C. Permeability: 1,400 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

2.2 SYNTHETIC GRASS SURFACING

- A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing and infill indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ForeverLawn.
 - b. SYNLawn; a SportGroup company.
- B. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

1. Yarn Fiber: Polyethylene.
- C. Backing: Manufacturer's standard woven or nonwoven polypropylene primary backing with urethane-coated secondary backing; provide perforations or drainage channels sufficient to meet permeability indicated.
- D. Infill: Manufacturer's standard sand and rubber infill.
 1. Infill Proportions: Manufacturer's standard proportions.
- E. Seaming Method: Adhesive.

2.3 MATERIALS

- A. Rubber Infill: Ground latex-coated SBR crumb rubber mesh free of metal, nonmetal fibers, and contaminants; mesh size as recommended by synthetic grass surfacing manufacturer.
- B. Sand Infill: Uniformly sized latex-coated silica sand free of silts, clays, and contaminants, and of subangular or rounder shape according to ASTM F1632; mesh size as recommended by synthetic grass surfacing manufacturer.
- C. Seam Adhesive: One- or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.
- D. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide.
- E. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, 5 mm thick. Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Avoid disturbance of base during installation of shock-attenuation pad and turf fabric.
- B. Shock-Attenuation Pad Installation: Roll out pad and allow to relax a minimum of six hours prior to final fit and trim. Stagger head seams between adjacent rows. Fit seams snugly without stretching or forcing.
- C. Roll out turf fabric and allow to relax at least four hours prior to seaming.
- D. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.
- E. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

- F. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION 321813

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.
 - 2. Swing gates.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete and post footings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include accessories, hardware, gate operation, and operational clearances.
- C. Samples: For each type of factory-applied finish.
- D. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Product Certificates: For each type of chain-link fence, and gate.
- C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 - 1. Design Wind Load: As indicated on Drawings.
 - a. Minimum Post Size: Determine according to ASTM F1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F1043, Schedule 40 steel pipe.
 - b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.
- C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire for Fabric: Wire diameter of 0.148 inch.
 - a. Mesh Size: 2 inches.
 - b. Polymer-Coated Fabric: ASTM F668, Class 2a over zinc-coated steel wire.
 - 1) Color: Black, according to ASTM F934.
 - c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
 - 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 6.625 inches in diameter.
 - b. End, Corner, and Pull Posts: 6.625 inches in diameter.
3. Horizontal Framework Members: top rails according to ASTM F1043.
 - a. Top Rail: 1.66 inches in diameter.
4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. zinc coating according to ASTM A653/A653M.
 - b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
 - d. Coatings: Any coating above.
6. Polymer coating over metallic coating.
 - a. Color: Black, according to ASTM F934.

2.4 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.148-inch- diameter, tension wire according to ASTM F1664, Class 2a over zinc-coated steel wire.
 1. Color: Black, according to ASTM F934.

2.5 SWING GATES

- A. General: ASTM F900 for gate posts and single swing gate types.
 1. Gate Leaf Width: As indicated.
 2. Framework Member Sizes and Strength: Based on gate fabric height of 72 inches or less.
- B. Pipe and Tubing:
 1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
 2. Gate Posts: Round tubular steel.
 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 1. Hinges: 360-degree inward and outward swing.
 2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

3. Lock: Manufacturer's standard internal device.
4. Closer: Manufacturer's standard.

2.6 FITTINGS

- A. Provide fittings according to ASTM F626.
- B. Post Caps: Provide for each post.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F626.
 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- I. Finish:
 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
 - a. Polymer coating over metallic coating.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

- A. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
 1. Connectors for Below-Grade Use: Exothermic welded type.

2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.
 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Place top of concrete 2 inches below grade to allow covering with surface material.
 - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
 - d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 10 feet o.c.
- F. Post Bracing: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - 1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
4. Ground fence on each side of gates and other fence openings.
 - a. Bond metal gates to gate posts.
 - b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 323113

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative aluminum fences.
2. Swing gates.

B. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete.
2. Section 281500 "Access Control Hardware Devices" for access control devices installed at gates and provided as part of a security system.
3. Division 26 Sections for electrical service and connections for system disconnect switches and powered devices including, but not limited to, motor operators, controls, and limit switches.

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: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting details, and grounding details.
2. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

- ##### C. Samples: For each fence material and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- ##### A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Wind Loading:

1. Fence Height: 0 to 15 feet.
 2. Wind Exposure Category: B.
 3. Design Wind Speed: 105 mph.
- B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES

- A. Decorative Aluminum Fences: Fences made from aluminum extrusions.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Ameristar Perimeter Security; ASSA ABLOY; Echelon Plus, Majestic Style Option or a comparable product by one of the following:
 - a. Elegant Aluminum Products, Inc.
 - b. Elite Fence Products, Inc.
 - c. Fortress Building Products.
 - d. Knotwood; OmniMax International, Inc.
 - e. Superior Aluminum Products, Inc.
- B. Posts: Square extruded tubes.
1. Line Posts: 2-1/2 by 2-1/2 inches with 0.060-inch wall thickness.
 2. End and Corner Posts: 2-1/2 by 2-1/2 inches with 0.060-inch wall thickness.
 3. Swing Gate Posts: 2-1/2 by 2-1/2 inches with 0.060-inch wall thickness.
- C. Post Caps: Aluminum castings.
- D. Rails: Extruded-aluminum channels, 1-7/162 by 1-1/4 inches, with 0.110-inch-thick sidewalls and 0.090-inch-thick top.
- E. Pickets: Extruded-aluminum tubes, 3/4-inch square, with 0.045-inch wall thickness.
1. Terminate tops of pickets at top rail for flush top appearance.
 2. Picket Spacing: 4 inches clear, maximum.
- F. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers.
- G. Fabrication: Assemble fences into sections by fastening pickets to rails.
1. Fabricate sections with clips welded to rails for field fastening to posts.
 2. Drill clips for fasteners before finishing.
- H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- I. Finish: Baked enamel or powder coating.

2.3 SWING GATES

- A. Gate Configuration: Single leaf or double leaf as indicated.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 1-3/4 by 1-1/2 inches with 0.125-inch wall thickness.
- E. Frame Corner Construction: Welded or assembled with corner fittings.
- F. Additional Rails: Provide as indicated, complying with requirements for fence rails.
- G. Infill: Comply with requirements for adjacent fence.
- H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 1. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence.
- I. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide.
- J. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
 - 1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
 - 2. Material: Malleable iron; galvanized.
- K. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
 - 1. Function: 39 - Full surface, triple weight, antifriction bearing.
 - 2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.
- L. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail-safe, and suitable for exterior use.
 - 1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch-thick, aluminum plate.
 - 2. Mounting: Mortise into post.
- M. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
 - 1. Function: 04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key.
 - 2. Mounting Channel: Bent-plate channel formed from 1/8-inch-thick, aluminum plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch beyond push pad surface.

- N. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- O. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.
- P. Metallic-Coated-Steel Finish: High-performance coating.
- Q. Steel Finish: High-performance coating.
- R. Aluminum Finish: Baked enamel or powder coating.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
- B. Extrusions: ASTM B221, Alloy 6063-T5.
- C. Tubing: ASTM B429/B429M, Alloy 6063-T6.
- D. Plate and Sheet: ASTM B209, Alloy 6061-T6.
- E. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
- F. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- C. Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Bar Grating: NAAMM MBG 531.
 - 1. Bars: Hot-rolled steel strip, ASTM A1011/A1011M, Commercial Steel, Type B.
 - 2. Wire Rods: ASTM A510/A510M.
- E. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A1011/A1011M, Structural Steel, Grade 45 or cold-rolled steel sheet, ASTM A1008/A1008M, Structural Steel, Grade 50.
- F. Aluminum-Zinc, Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, with AZ60 coating.
- G. Castings: Either gray or malleable iron unless otherwise indicated.
 - 1. Gray Iron: ASTM A48/A48M, Class 30.
 - 2. Malleable Iron: ASTM A47/A47M.

2.6 COATING MATERIALS

- A. Shop Primer for Steel: Manufacturer's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Epoxy Zinc-Rich Primer for Uncoated Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.
- C. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
- D. Epoxy Intermediate Coat for Uncoated Steel: Complying with MPI #77 and compatible with primer and topcoat.
- E. Intermediate Coat for Uncoated Steel: Epoxy or polyurethane intermediate recommended in writing by primer and topcoat manufacturer.
- F. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

- A. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Aluminum.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic-welded type.
 - 2. Grounding Rods: Copper-clad steel.

- a. Size: 5/8 by 96 inches.

2.9 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.10 STEEL FINISHES

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.
- D. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 - 1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening rails and infill panels to posts.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
 - b. Concealed Concrete: Top 2 inches below grade as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
 - 4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
 - a. Extend posts at least 5 inches into sleeve.
 - b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
 - 1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than

natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 323119

SECTION 323223 - SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Segmental retaining walls.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation for segmental retaining walls, base material, soil fill, fill placement and compaction, and field in-place density testing.

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:

1. Show sizes, profiles, coursing, and locations of retaining wall units; including backfill and leveling base materials.
2. Show types, sizes, locations of soil reinforcing materials.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples: For each type of exposed finish of segmental retaining wall units.

D. Delegated Design Submittals: For segmental retaining walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers certified under the National Concrete Masonry Association (NCMA) Certified Segmental Retaining Wall Installer program at the Basic certification level.

2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
3. Testing Agency: Qualified in accordance with ASTM E329 for testing indicated.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:
 1. Test soil reinforcement and backfill materials for pullout resistance in accordance with ASTM D6706.
 2. Test soil reinforcement and backfill materials for coefficient of friction in accordance with ASTM D5321/D5321M.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.
- B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them. Verify identification of geosynthetics before use, and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design segmental retaining walls.
- B. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.
- C. Structural Performance: Engineering design shall be based on the following loads and be in accordance with NCMA's "Design Manual for Segmental Retaining Walls."
 1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
 2. Superimposed loads (surcharge) indicated on Drawings.
 3. Horizontal Peak Ground Acceleration (A) for Project: Refer to Soils Report and Structural Drawings.

2.2 SEGMENTAL RETAINING WALL UNITS

- A. Concrete Units: ASTM C1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch from specified dimension.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allan Block Corporation.
 - b. Anchor Wall Systems, Inc.
 - c. CornerStone Wall Solutions Inc.
 - d. GeoStone Retaining Wall Systems, Inc.
 - e. ICD Corporation.
 - f. Keystone Retaining Wall Systems, Inc.
 - g. Nicolock.
 - h. Risi Stone Systems.
 - i. Rockwood Retaining Walls, Inc.
 - j. Tensor Earth Technologies, Inc.
 - k. Unilock Group of Companies.
 - l. Versa-Lok Retaining Wall Systems.
 - m. Westblock Systems.
2. Provide units that comply with requirements in ASTM C1372 for freeze-thaw durability.
3. Provide units that interlock with courses above and below by means of integral lugs, lips, or tongues and grooves, pins, splines, and/or hollow cores filled with drainage fill.

B. Color: As selected by Architect from manufacturer's full range.

C. Shape and Texture:

1. Provide units with machine-split textured, flat exposed face.
2. Provide units of any basic shape and dimensions that produce segmental retaining walls of dimensions and profiles indicated without interfering with other elements of the Work and with machine-split textured, flat exposed face.

D. Cap Units: Provide cap units of shape indicated with smooth, as-cast top surfaces without holes or lugs.

E. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face.

2.3 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base and drainage course.

1. Leveling Course: Lean concrete with a compressive strength of not more than 500 psi.

- E. Drainage Fill: Comply with requirements in Section 312000 "Earth Moving" for drainage course.
- F. Reinforced Soil Fill:
 - 1. Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.
 - 2. ASTM D2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; complying with the following gradation in accordance with ASTM C136/C136M: 20 to 100 percent passing No. 4 sieve, zero to 60 percent passing No. 40 sieve, zero to 35 percent passing No. 200 sieve, and with fine fraction having a plasticity index of less than 20.
- G. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.
- H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- I. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation of greater than 50 percent.
 - 1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D4751.
 - 2. Minimum Grab Tensile Strength: 110 lb; ASTM D4632/D4632M.
 - 3. Minimum Weight: 4 oz./sq. yd.
- J. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonar Inc.; a Low & Bonar company.
 - b. Propex Fabrics Inc.
 - c. Tenax Corporation - USA.
 - d. Tensar Earth Technologies, Inc.
 - e. Versa-Lok Retaining Wall Systems.
 - 2. Product Type: Molded geogrid made from high-density polyethylene.

2.4 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D994, asphalt expansion joint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF RETAINING WALLS

- A. General: Place units in accordance with NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.
 - 1. Lay units in running bond pattern unless otherwise indicated.
 - 2. Form corners and ends by using special units, cutting units with motor-driven saw, or splitting units with mason's hammer and chisel.
- B. Do not use units with chips, cracks, or other defects that are visible at a distance of 20 feet where such defects are exposed in the completed Work.
- C. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight in accordance with ASTM D698.
 - 1. Leveling Course: At Contractor's option, unreinforced lean concrete may be substituted for upper 1 to 2 inches of base. Compact and screed concrete to a smooth, level surface.
- D. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.
 - 1. Tamp units into leveling base as necessary to bring tops of units into a level plane.
- E. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
 - 1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
 - 2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
 - 3. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
 - 4. For units with pins, install pins and align units.
 - 5. For units with clips, install clips and align units.
- F. Cap Units: Place cap units and secure with cap adhesive.
- G. Joint-Filler Strips: Install joint-filler strips at junctions with vertical surfaces including concrete foundation walls, and other locations, as indicated. Install joint-filler strips in accordance with manufacturer's written instructions.

3.3 FILL PLACEMENT

- A. General: Comply with requirements in Section 312000 "Earth Moving," with NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.
- B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.
- C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall, and place and spread fills toward embankment.

1. Use only hand-operated compaction equipment within 48 inches of wall or one-half of height above bottom of wall, whichever is greater.
 2. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight in accordance with ASTM D698.
 - a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight in accordance with ASTM D698.
 - b. In areas where fill height exceeds 15 feet compact reinforced-soil fill that will be more than 15 feet below finished grade to not less than 98 percent maximum dry unit weight in accordance with ASTM D698.
 - c. In areas where fill height exceeds 30 feet compact reinforced-soil fill that will be more than 30 feet below finished grade to not less than 100 percent maximum dry unit weight in accordance with ASTM D698.
 3. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."
- D. Place drainage geotextile against back of wall, and place layer of drainage fill at least 12 inches wide behind drainage geotextile to within 12 inches of finished grade. Place another layer of drainage geotextile between drainage fill and soil fill.
 - E. Place a layer of drainage fill at least 12 inches wide behind wall to within 12 inches of finished grade. Place a layer of drainage geotextile between drainage fill and soil fill.
 - F. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated, sloped not less than 0.5 percent to drain.
 - G. Place impervious fill over top edge of drainage fill layer.
 - H. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at wall base away from wall. Provide uniform slopes that prevent ponding.
 - I. Place soil reinforcement in horizontal joints of retaining wall where indicated and in accordance with soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.
 1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
 2. Place geosynthetics with seams, if any, oriented perpendicularly to segmental retaining walls.
 3. Do not dump fill material directly from trucks onto geosynthetics.
 4. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.
 5. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet, 3 inches maximum.

- B. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.
- C. Maximum Gap between Units: 1/8 inch.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Comply with requirements in Section 312000 "Earth Moving" for field quality control.
- C. Tests and Inspections:
 - 1. In each compacted backfill layer, perform at least one field in-place compaction test for each 150 feet or less of segmental retaining wall length.
 - 2. In each compacted backfill layer, perform at least one field in-place compaction test for each 24 inches of fill depth and each 50 feet or less of segmental retaining wall length.
 - 3. Segmental retaining wall system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Remove and replace segmental retaining wall construction of the following descriptions:
 - 1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.
 - 2. Segmental retaining walls that do not match approved Samples.
 - 3. Segmental retaining walls that do not comply with other requirements indicated.
- B. Replace units so segmental retaining wall matches approved Samples, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 323223

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seating.
2. Trash receptacles.
3. Planters.
4. Dog Park Equipment.
5. Outdoor fire pits.
6. Outdoor grills.
7. Outdoor Kitchen trash receptacles.
8. Outdoor ice makers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Product Schedule: For site furnishings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Trash Receptacle Inner Containers: Five full-size units for each size indicated, but no fewer than two units.

PART 2 - PRODUCTS

2.1 SEATING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Victor Stanley, Inc; Eva Bench or approved equal.
- B. Frame: Steel.
- C. Seat Material:
 - a. Wood: IPE; formed into evenly spaced parallel slats.
2. Overall Length: 6 feet.
- D. Steel Finish: TGIC polyester powder coated.
 1. Color: Black

2.2 TRASH RECEPTACLES

A. Products: Subject to compliance with requirements, provide the following:

1. Victor Stanley, Inc; SDC-36.

B. Steel Facing Surrounds: Evenly patterned, parallel flat steel straps or bars, or tubular shapes.

C. Trash Receptacles:

1. Receptacle Shape and Form: Round cylinder with flared funnel top; with opening for depositing trash in top.
2. Lids and Tops: Matching facing panels secured by cable or chain, hinged, swiveled, or permanently secured.
 - a. Description: Dome top with rain bonnet.
3. Receptacle Height: 41-3/8 inch.
4. Overall Width: 24-5/8 inch.
5. Inner Container: Rigid plastic container with drain holes and lift-out handles; designed to be removable and reusable.
6. Disposable Liners: Provide receptacle designed to accommodate disposable liners.
7. Capacity: Not less than 36 gal.
8. Service Access: Removable lid or top; inner container and disposable liner lift or slide-out for emptying.

D. Steel Finish: TGIC polyester powder coated.

1. Color: Black.

2.3 PLANTERS

A. Round, Tapered Column Planter:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by the following:
 - a. Madison Planter; Crescent Garden Company.
2. Planter Shape and Form: Round, tapered column.
3. Overall Height: 34-inches.
4. Overall Diameter: 34-inches.
5. Installation Method: Freestanding.
6. Color: As selected by Architect from manufacturer's full range.
7. Accessories: Matching Saucer.

2.4 DOG PARK EQUIPMENT

A. Pet Waste Disposal Station:

1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. DOGIPOT®.

2. Aluminum Dogipot Pet Station: #1003-L, black.
- B. Faux Fire Hydrant:
 1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. Bark Park®; an UltraSite Company.
 2. Fire Hydrant: TBARK-465, red.

2.5 OUTDOOR FIRE PIT

- A. Outdoor Fire Pits:
 1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. HPC Fire Inspired™.
 2. Rectangular Insert Models.
 3. Accessories:
 - a. Fire Pit Media: As selected by Owner.
 - b. Glass Wind Guards.
 - c. 2 Hour Timer.
 - d. Emergency Shutoff.
 - e. Enclosure Vents as required.

2.6 OUTDOOR GRILLS

- A. Manufacturers: Subject to compliance with requirements, provide the following:
 1. Coyote® Outdoor Living, Inc.
- B. Natural Gas Grill: S-Series, Model C2SL42NG:
 1. Features:
 - a. 4 high performance Coyote Infinity burners.
 - b. 1 infrared rear burner for rotisserie cooking.
 - c. Interior Grill Lighting.
 - d. LED illuminated knobs.
 - e. Rotisserie Kit and Smoker Box.
 2. Accessories:
 - a. Laster-Cut Signature Grates (CSIGRATE15).
 - b. Charcoal trays (CCHTRAY15).
 - c. Stainless Steel Griddle (C1GRDL).
 - d. Custom fit, weather resistant cover.
 - e. Insulated jacket.
 - f. Vent covers (COYVENT).
 3. Utility Requirements:
 - a. Natural Gas: 1/2-inch-dia. connection. 4-inch WC Pressure. 0.5 psi maximum.
 - b. Electrical: 1 – 120 VAC 60 Hz grounded plug.
 4. Double Access Doors:
 - a. 39-inch double access doors (Model CDA2439).

2.7 OUTDOOR KITCHEN TRASH RECEPTACLES

- A. Manufacturers: Subject to compliance with requirements, provide the following:
 - 1. Coyote® Outdoor Living, Inc.
- B. Dual Pull-Out Trash and Recycle: Model CTC.
 - 1. Features:
 - a. Professional style Coyote stainless steel handles.
 - b. Full extension drawer on rollers for smooth operation.
 - c. Each drawer contains a 13-gallon trash can.

2.8 OUTDOOR ICE MAKERS

- A. Manufacturers: Subject to compliance with requirements, provide the following:
 - 1. Ice-O-Matic.
- B. Ice Machine: GEMU090P - Pearl Ice Maker.
 - 1. Drain Type: Pump.
 - 2. Cabinet Finish: Stainless Steel.
 - 3. Front Finish: Stainless Steel.
 - 4. Features: Outdoor approved.

2.9 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
 - 1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B211.
 - 2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B221.
 - 3. Structural Pipe and Tube: ASTM B429/B429M.
 - 4. Sheet and Plate: ASTM B209.
 - 5. Castings: ASTM B26/B26M.
- B. Steel and Iron: Free of surface blemishes and complying with the following:
 - 1. Plates, Shapes, and Bars: ASTM A36/A36M.
 - 2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
 - 3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
 - 4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
 - 5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
 - 6. Perforated Metal: From steel sheet not less than 0.075-inch nominal thickness; manufacturer's standard perforation pattern.
 - 7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F1267.
 - 8. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended by fabricator for type of use intended.

9. Gray-Iron Castings: ASTM A48/A48M, Class 200.
- C. Stainless Steel: Free of surface blemishes and complying with the following:
 1. Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666.
 2. Pipe: Schedule 40 steel pipe complying with ASTM A312/A312M.
 3. Tubing: ASTM A554.
 - D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
 1. Finish: Manufacturer's standard stain and transparent sealer.
 - E. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
 - F. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
 1. Polyethylene: Fabricated from virgin plastic HDPE resin.
 - G. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, concealed, recessed, and capped or plugged.
 - H. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.
 - I. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
 - J. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
 2. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

2.10 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed

connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.11 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 ALUMINUM FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.14 IRON FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.15 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run directional finishes with long dimension of each piece.
 - 2. Directional Satin Finish: ASTM A480/A480M, No 4.
 - 3. Dull Satin Finish: ASTM A480/A480M, No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 323300

SECTION 328400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Miscellaneous piping specialties.
9. Sprinklers.
10. Quick couplers.
11. Controllers.
12. Boxes for automatic control valves.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for water metering requirements.

1.2 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers, which use some method of weather-based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET, broadcasting of ET measurements, or use of on-site sensors to track ET.
- D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipes, tubes, and fittings.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.

6. Automatic drain valves.
 7. Transition fittings.
 8. Miscellaneous piping specialties.
 9. Sprinklers.
 10. Quick couplers.
 11. Controllers.
 12. Boxes for automatic control valves.
 13. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated Design Submittal: For irrigation systems 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. Coordination Drawings: Irrigation systems, drawn to scale, on which components are indicated and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions, such as signs and light standards.
- B. Zoning Chart: Indicate each irrigation zone and its control valve.
- C. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- D. Field Quality-Control Submittals:
1. Field quality-control reports.
- E. Qualification Statements: For Installer.
- F. Delegated design engineer qualifications.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinklers, controllers, and automatic control valves to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Impact Sprinklers: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than 2 units.
 2. Spray Sprinklers: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than 2 units.
 3. Bubblers: Equal to 10 percent of amount installed for each type indicated, but no fewer than 2 units.
 4. Emitters: Equal to 10 percent of amount installed for each type indicated, but no fewer than 2 units.
 5. Soaker Tubes: Equal to 10 percent of total length installed for each type and size indicated, but not less than 50 ft.

- B. Schedule of maintenance material items.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs one of the following:
 - a. Certified Irrigation Designer - Landscape qualified by the Irrigation Association.
 - b. Professional Class member of the American Society of Irrigation Consultants.
 - c. Professional Technical Class member of the American Society of Irrigation Consultants.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

1.9 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Irrigation Zone Control: Automatic operation with controller and automatic control valves.
- B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions, such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
 1. Irrigation Main Piping: 200 psig.
 2. Circuit Piping: 150 psig.

2.2 PIPES, TUBES, AND FITTINGS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

- B. Galvanized-Steel Pipe: ASTM A53/A53M, Standard Weight, Type E, Grade B.
 - 1. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless-steel pipe with threaded ends.
 - 2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - 3. Cast-Iron Flanges: ASME B16.1, Class 125.
- C. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111 rubber.
- E. PE Pipe with Controlled ID: ASTM D2239, PE 3408 compound; SDR 11.5 and SDR 15.
 - 1. Insert Fittings for PE Pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
- F. PE Pipe with Controlled OD: ASTM D3035, PE 3408 compound, SDR 11.
 - 1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
 - 2. PE Socket-Type Fittings: ASTM D2683.
- G. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating of not less than 200 psig.
 - 1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
 - 2. PE Socket-Type Fittings: ASTM D2683.
- H. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedule 40.
 - 1. PVC Socket Fittings: ASTM D2466, Schedule 40.
 - 2. PVC Threaded Fittings: ASTM D2464, Schedule 80.
- I. PVC Pipe, Pressure Rated: ASTM D2241, PVC 1120 compound, SDR 21 and SDR 26.
 - 1. PVC Socket Fittings: ASTM D2467, Schedule 80.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.

- E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 ENCASUREMENT FOR PIPING

- A. Standard: ASTM A674 or AWWA C105.
- B. Form: Sheet or tube.
- C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
- D. Color: Black or Natural.

2.5 MANUAL VALVES

A. Curb Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Amcast Industrial Corporation.
 - c. Ford Meter Box Company, Inc. (The).
 - d. Jones, James Company.
 - e. Mueller Co.
 - f. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
- 2. Description:
 - a. Standard: AWWA C800.
 - b. NPS 1 and Smaller Pressure Rating: 150 psig.
 - c. NPS 1-1/4 to NPS 2 Pressure Rating: 150 psig.
 - d. Body Material: Brass or bronze with ball or ground-key plug.
 - e. End Connections: Matching piping.
 - f. Stem: With wide-tee head.

B. Curb-Valve Casing:

- 1. Standard: Similar to AWWA M44 for cast-iron valve casings.
- 2. Top Section: Telescoping, of length required for depth of burial of curb valve.
- 3. Barrel: Approximately 3-inch diameter.
- 4. Plug: With lettering "WATER."
- 5. Bottom Section: With base of size to fit over valve.
- 6. Base Support: Concrete collar.

C. Shutoff Rods for Curb-Valve Casings: Furnish two steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Brass Ball Valves:

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

- a. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded or solder joint if indicated.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full or regular, but not reduced.
- E. Bronze Gate Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. Class: 125.
 - c. CWP Rating: 200 psig.
 - d. Body Material: ASTM B62 bronze with integral seat and screw-in bonnet.
 - e. Ends: Threaded or solder joint.
 - f. Stem: Bronze, nonrising.
 - g. Disc: Solid wedge; bronze.
 - h. Packing: Asbestos free.
 - i. Handwheel: Malleable iron, bronze, or aluminum.
- A. Iron Gate Valves, Resilient Seated:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. NIBCO INC.
 - 2. Description:
 - a. Standard: AWWA C509.
 - b. Pressure Rating: 250 psig minimum.
 - c. Body Material: Ductile or gray iron with bronze trim.
 - d. End Connections: Mechanical joint or push-on joint.
 - e. Interior Coating: Comply with AWWA C550.
 - f. Body Design: Nonrising stem.
 - g. Operator: Stem nut.
 - h. Disc: Solid wedge with resilient coating.

2.6 PRESSURE-REDUCING VALVES

- A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. Cash Acme, A Division of Reliance Worldwide Corporation.
 - c. Honeywell International Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Description:
 - a. Standard: ASSE 1003.
 - b. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
 - c. Pressure Rating: Initial pressure of 150 psig.
 - d. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CLA-VAL.
 - b. Flomatic Corporation.
 - c. OCV Control Valves.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Description: Pilot-operation, diaphragm-type, single-seated main water-control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - a. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless steel body.
 - b. Pattern: Globe-valve design.
 - c. Trim: Stainless steel.
 - d. Pressure Rating: Initial pressure of 150 psig minimum.
 - e. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.7 AUTOMATIC CONTROL VALVES

A. Plastic, Automatic Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hunter Industries Incorporated.
 - b. Nelson, L. R. Corporation.
 - c. Rain Bird Corporation.
 - d. Toro Company (The).
2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24 V ac solenoid.

2.8 AUTOMATIC DRAIN VALVES

- A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.9 TRANSITION FITTINGS

- A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries, Inc.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Harvel Plastics, Inc.
 - b. Spears Manufacturing Company.
 - 2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

2.10 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.
- B. Pressure Gages: ASME B40.1. Include 4-1/2-inch-diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.11 SPRINKLERS

- A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.
- B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckner; a Storm Manufacturing Group, Inc. brand.
 - b. Hunter Industries Incorporated.
 - c. Nelson, L. R. Corporation.
 - d. Rain Bird Corporation.

- e. Toro Company (The).
 - 2. Description:
 - a. Body Material: ABS.
 - b. Nozzle: Brass.
 - c. Retraction Spring: Stainless steel.
 - d. Internal Parts: Corrosion resistant.
 - 3. Capacities and Characteristics:
 - a. Pop-up Height: 4 inches aboveground to nozzle.
 - b. Arc: Full circle.
 - c. Inlet: NPS 1/2 or NPS 3/4.
- C. Plastic, Pop-up Spray Sprinklers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckner; a Storm Manufacturing Group, Inc. brand.
 - b. Hunter Industries Incorporated.
 - c. Nelson, L. R. Corporation.
 - d. Rain Bird Corporation.
 - e. Toro Company (The).
 - 2. Description:
 - a. Body Material: ABS.
 - b. Nozzle: Brass.
 - c. Retraction Spring: Stainless steel.
 - d. Internal Parts: Corrosion resistant.
 - e. Pattern: Fixed, with flow adjustment.
 - 3. Capacities and Characteristics:
 - a. Pop-up Height: 4 inches aboveground to nozzle.
 - b. Arc: Full circle.
 - c. Inlet: NPS 1/2 or NPS 3/4.

2.12 QUICK COUPLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Buckner; a Storm Manufacturing Group, Inc. brand.
 - 2. Hunter Industries Incorporated.
 - 3. Nelson, L. R. Corporation.
 - 4. Rain Bird Corporation.
 - 5. Toro Company (The).
- B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
 - 1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.13 CONTROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hunter Industries Incorporated.
 2. Nelson, L. R. Corporation.
 3. Rain Bird Corporation.
 4. Toro Company (The).
- B. Description:
1. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
 2. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.
 - a. Body Material: Molded plastic.
 - b. Mounting: Surface type for wall.
 3. Control Transformer: 24 V secondary, with primary fuse.
 4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.
 - a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
 - b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
 - c. Surge Protection: Metal-oxide-varistor type on each station and primary power.
 5. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
 6. Smart Controllers: Use ET, tested in accordance with IA SWAT Climatological Based Controllers 8th Draft Testing Protocol and compliant with ASHRAE 189.1.
 7. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 - a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 - b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 - c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.14 BOXES FOR AUTOMATIC CONTROL VALVES

- A. Plastic Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated.

- b. Nationwide Plastics, Inc.
 - c. NewBasis.
 - d. Oldcastle Infrastructure Inc.; CRH Americas.
 - e. Orbit Irrigation Products, Inc.
 - f. USFilter/Plymouth Products, Inc.
2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
- a. Size: As required for valves and service.
 - b. Shape: Rectangular.
 - c. Sidewall Material: PE, ABS, or FRP.
 - d. Cover Material: PE, ABS, or FRP.
- 1) Lettering: " IRRIGATION."
- B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- B. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- C. Provide minimum cover over top of underground piping according to the following:
 - 1. Irrigation Main Piping: Minimum depth of 36 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
 - 2. Circuit Piping: 12 inches.
 - 3. Drain Piping: 12 inches.
 - 4. Sleeves: 24 inches.

3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 INSTALLATION OF PIPING

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.

- F. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- G. Install underground thermoplastic piping in accordance with ASTM D2774.
- H. Install expansion loops in control-valve boxes for plastic piping.
- I. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- J. Install ductile-iron piping in accordance with AWWA C600.
- K. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- L. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
- M. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
- N. Install piping in sleeves under parking lots, roadways, and sidewalks.
- O. Install sleeves made of Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
- P. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 and Larger: AWWA transition couplings.
 - 2. Aboveground Piping:
 - a. NPS 2 and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Select rubber gasket material of size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
- F. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners in accordance with piping manufacturer's written instructions.

- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- H. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings in accordance with ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings in accordance with ASTM D2855.
 - 3. PVC Nonpressure Piping: Join in accordance with ASTM D2855.

3.5 INSTALLATION OF VALVES

- A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
- B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
 - 1. Install valves and PVC pipe with restrained, gasketed joints.
- C. Aboveground Valves: Install as components of connected piping system.
- D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass.
- E. Throttling Valves: Install in underground piping in boxes for automatic control valves.
- F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 INSTALLATION OF SPRINKLERS

- A. Install sprinklers after hydrostatic test is completed.
- B. Install sprinklers at manufacturer's recommended heights.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

3.7 INSTALLATION OF AUTOMATIC IRRIGATION CONTROL SYSTEM

- A. Equipment Mounting, Interior: Install controllers on interior wall.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Equipment Mounting, Exterior: Install exterior freestanding controllers on precast concrete bases.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

- C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.8 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221113 "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
- C. Connect wiring between controllers and automatic control valves.

3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
 - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service with Test Assistance: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Irrigation system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 STARTUP SERVICE

- A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that controllers are installed and connected in accordance with the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.12 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.13 CLEANING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.

END OF SECTION 328400

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
2. Sodding.
3. Erosion-control materials.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.2 DEFINITIONS

- A. Finish Grade:** Elevation of finished surface of planting soil.
- B. Pesticide:** A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests:** Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil:** Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade:** The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For landscape Installer.
- B. Certification of Grass Seed:** From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Product Certificates:** For fertilizers, from manufacturer.
- D. Pesticides and Herbicides:** Product label and manufacturer's application instructions specific to Project.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Lawn Care Manager.
 - c. Landscape Industry Certified Lawn Care Technician.
 - 3. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
 - 1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.

2. Quality, Non-State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
3. Full Sun, Warm-Season Grass: Bermudagrass (*Cynodon dactylon*).
4. Full Sun, Cool-Season Grass: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
5. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:
 - a. 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b. 30 percent chewings red fescue (*Festuca rubra* variety).
 - c. 10 percent perennial ryegrass (*Lolium perenne*).
 - d. 10 percent redtop (*Agrostis alba*).
6. Shade, Cool-Season Grass: Proportioned by weight as follows:
 - a. 50 percent chewings red fescue (*Festuca rubra* variety).
 - b. 35 percent rough bluegrass (*Poa trivialis*).
 - c. 15 percent redtop (*Agrostis alba*).

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

2.3 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 1. Composition:
 - a. 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 1. Composition:
 - a. 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.5 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
 - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- E. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
- D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.
3. Tree-watering devices.

B. Related Requirements:

1. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.2 DEFINITIONS

- A. Backfill:** The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock:** Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock:** Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock:** Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock:** Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock:** Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade:** Elevation of finished surface of planting soil.
- H. Pesticide:** A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests:** Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area:** Areas to be planted.

- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 COORDINATION

- A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- B. Samples: For each of the following:
 - 1. Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
 - 2. Mineral Mulch: 2 lb. of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
 - 3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Horticultural Technician.
 3. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
 1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods: From date of planting completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - c. Annuals: Three months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 1. Size: 10-gram tablets.
 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 1. Type: Shredded hardwood.
 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 3. Color: Natural.
- B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
 1. Type: Rounded riverbed gravel or smooth-faced stone.
 2. Size Range: 1-1/2 inches maximum, 3/4 inch minimum.
 3. Color: Uniform tan-beige color range acceptable to Architect.

2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.
3. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
5. Guy Cables: Five-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated compression springs, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.

2.7 TREE-WATERING DEVICES

- A. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BIO-PLEX.
 - b. Engineered Watering Solutions; PQ Partners, LLC.
 - c. Spectrum Products, Inc.
2. Color: As selected by Architect from manufacturer's full range.

2.8 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 - 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- B. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further

- disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter.
 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 7. Maintain supervision of excavations during working hours.
 8. Keep excavations covered or otherwise protected after working hours.
 9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Three for each caliper inch of plant.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 2. Carefully remove root ball from container without damaging root ball or plant.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Fabric Bag-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Three for each caliper inch of plant.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 1 inch above adjacent finish grade.
1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.
 3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.

4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
 - a. Quantity: Two per plant.
6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 1. Upright Staking and Tying:
 - a. Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - b. Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.
 1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

- a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide compression spring for each guy wire and tighten securely.
 - b. For trees more than 6 inches in caliper, anchor guys to wood deadmen buried at least 36 inches below grade. Provide compression spring for each guy wire and tighten securely.
 - c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to compression spring. Allow enough slack to avoid rigid restraint of tree.
 - d. Support trees with multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to compression spring. Allow enough slack to avoid rigid restraint of tree.
 - e. Attach flags to each guy wire, 30 inches above finish grade.
 - 2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
- C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
- 1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
 - a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees.
 - 2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.8 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
 - 3. Mineral Mulch in Planting Areas: Apply 3-inch average thickness of mineral mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

3.10 INSTALLATION OF SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree.
- B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.11 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.12 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.13 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
 2. Species of Replacement Trees: Same species being replaced.

3.14 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.15 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 1. Maintenance Period: 12 months from date of planting completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 1. Maintenance Period: Three months from date of planting completion.

END OF SECTION 329300

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 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. when tested in accordance with 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 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 deep and 12 inches 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.
- 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 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 on side away from footing and above top of pipe to within 12 inches 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.
- J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.3 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. 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.
- 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 underslab subdrainage.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.4 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed 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.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.5 LANDSCAPING DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- C. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- D. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- E. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. 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 in accordance with manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
 2. Underslab Subdrainage: Install piping level.
 3. Plaza Deck Subdrainage: Install piping level.
 4. 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 unless otherwise indicated.
 5. 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 unless otherwise indicated.
 6. Lay perforated pipe with perforations down.
 7. 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 in accordance with ASTM D2321.

3.7 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings in accordance with ASTM D3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings in accordance with 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. Cleanouts for Foundation and Retaining-Wall 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 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 deep. Set top of cleanout flush with grade.
 3. In nonvehicular-traffic areas, use NPS 4 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 deep. Set top of cleanout 1 inch above grade.
 4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."
- B. Cleanouts for Underslab Subdrainage:
1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.9 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping.
 - 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.

3.10 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

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

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.
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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

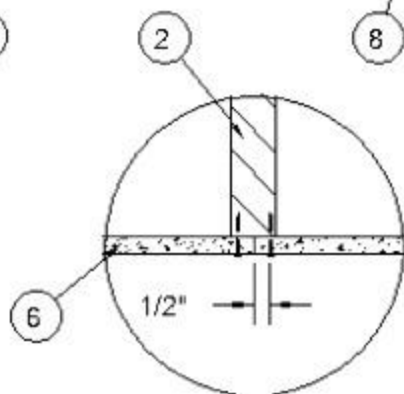
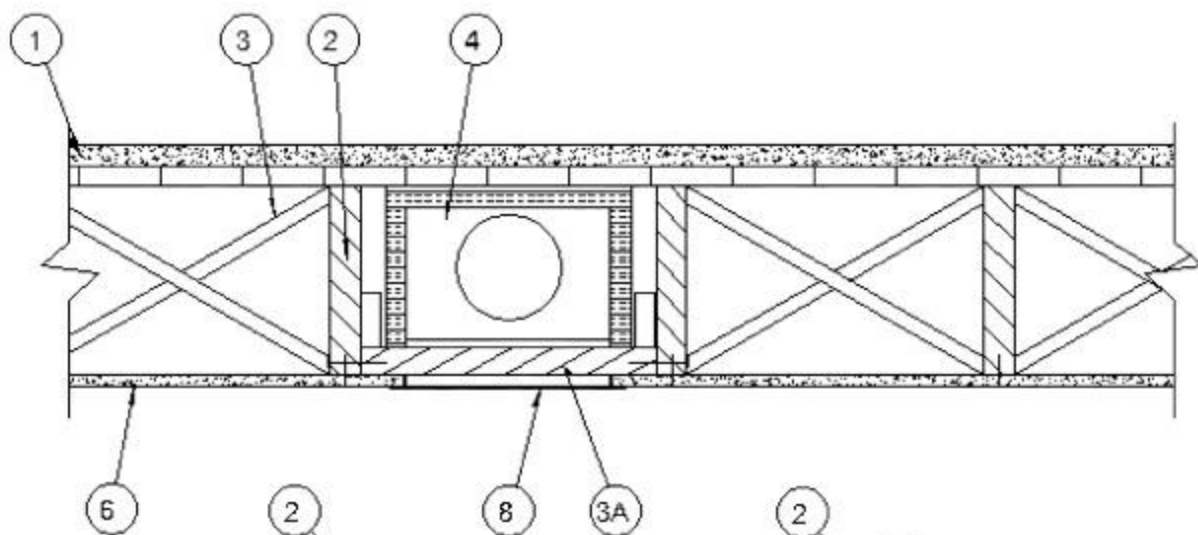
Design No. L523

September 2, 2024

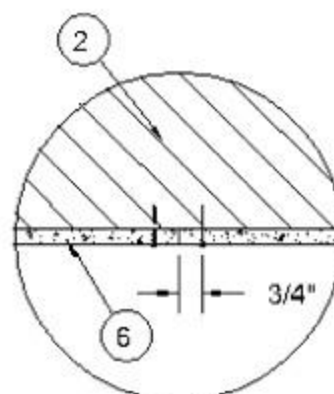
Unrestrained Assembly Rating — 1 Hr.**Finish Rating — 21 Min. or (16 Min. See Item 6A)**

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

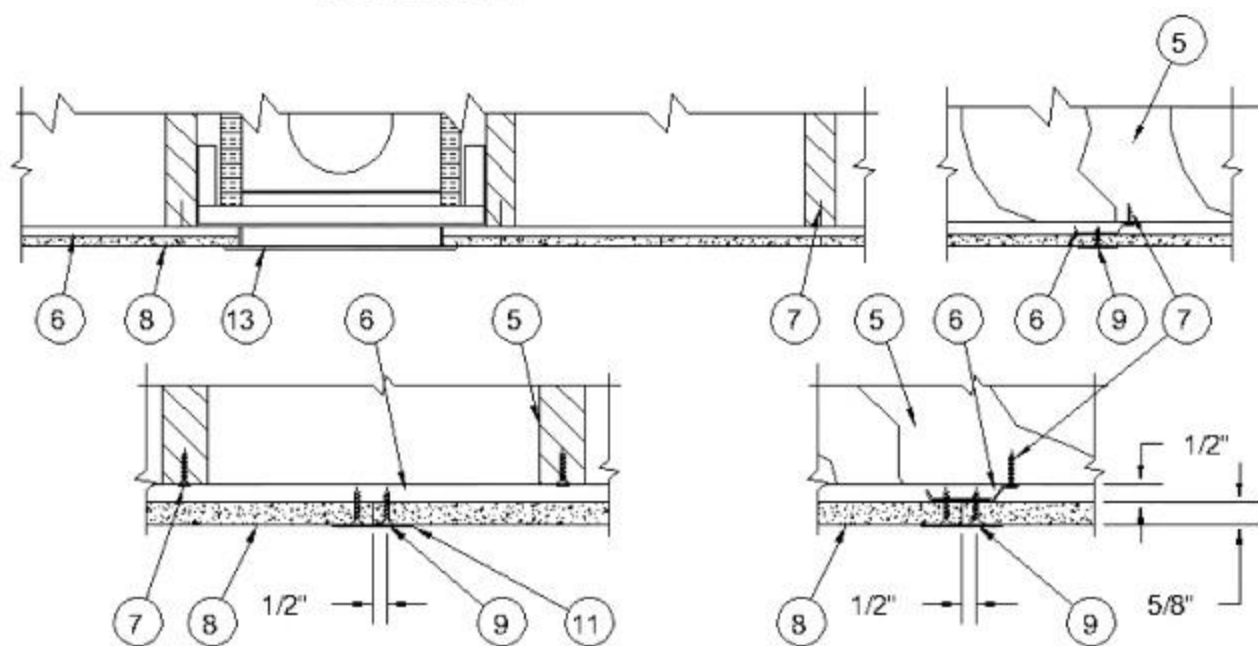
*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



End Joint Detail

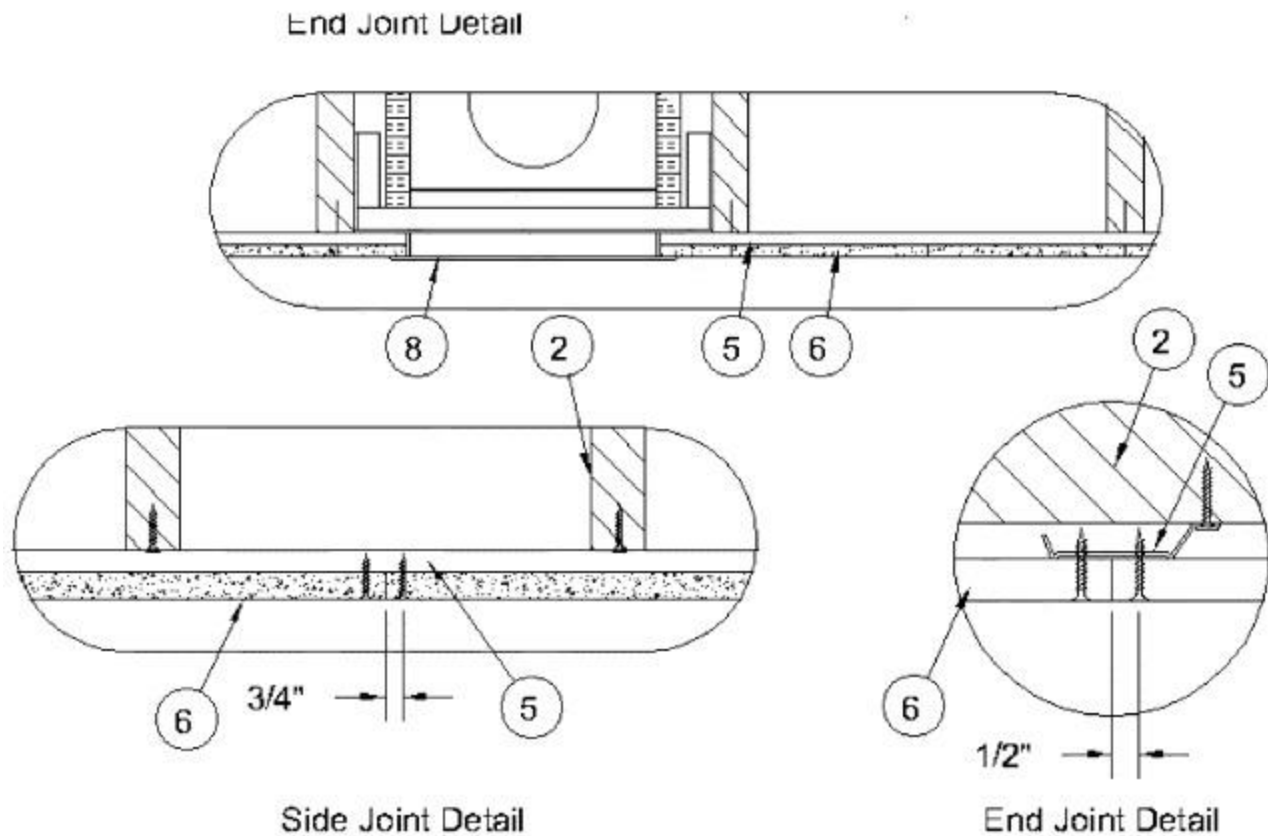


Side Joint Detail



Side Joint Detail

End Joint Detail



1. **Flooring System** — The flooring system shall consist of one of the following:

System No. 1

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.010 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1800 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

UNITED STATES GYPSUM CO — Types LRK, HSLRK, CSD

USG MEXICO S A DE C V — Types LRK, HSLRK, CSD

Floor Mat Materials* — (Optional) - Floor mat material nom 1/16 in. loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

UNITED STATES GYPSUM CO — Types SAM, LEVELROCK® Brand Sound Reduction Board, LEVELROCK® Brand Floor Underlayment SRM-25

Alternate Floor Mat Materials* — (Optional) - Nom 3/8 in. thick floor mat material loose laid over the subfloor.

GRASSWORX L L C — Type SC50

System No. 2

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Floor Mat Materials* — (Optional) — Floor mat material nom 5/64 in. (2mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1-1/4 in. of floor-topping mixture.

HACKER INDUSTRIES INC — Type Hacker Sound-Mat.

Alternate Floor Mat Materials - (Optional) — Floor mat material nom 1/4 in. (6mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1-1/4 in. (32mm) of floor-topping mixture.

HACKER INDUSTRIES INC — Type Hacker Sound-Mat II.

Alternate Floor Mat Materials - (Optional) — Floor mat material nom 1/8 in. (3mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1 in. (25mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 125

Alternate Floor Mat Materials - (Optional) — Floor mat material nom 1/4 in. (6mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1 in. (25mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 250, Quiet Qurl 55/025

Alternate Floor Mat Materials - (Optional) — Floor mat material nom 3/8 in. (10mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/4 in. (32mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 400, Quiet Qurl 60/040

Alternate Floor Mat Materials - (Optional) — Floor mat material nom 3/4 in. (19mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/2 in. (38mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 750, Quiet Qurl 65/075

Metal Lath (Optional) — For use with 3/8 in. (10 mm) floor mat materials, 3/8 in. expanded steel diamond mesh, 3.4 lbs/sq yd placed over the floor mat material. Hacker Floor Primer to be applied prior to the placement of the metal lath. When metal lath is used, floor topping thickness a nom 1-1/4 in. over the floor mat.

Finish Flooring - Floor Topping Mixture* — Min 1 in. thickness of floor topping mixture having a min compressive strength of 1100 psi. Mixture shall consist of 6.8 gal of water to 80 lbs of floor topping mixture to 1.9 cu ft of sand.

HACKER INDUSTRIES INC — Firm-Fill Gypsum Concrete, Firm-Fill 2010, Firm-Fill 3310, Firm-Fill 4010, Firm-Fill High Strength, Gyp-Span Radiant.

System No. 3

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 1 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Mixture shall consist of 5 to 8 gal of water to 80 lbs of floor topping mixture to 2.1 cu ft of sand.

ULTRA QUIET FLOORS — Types UQF-A, UQF-Super Blend, UQF-Plus 2000.

System No. 4

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1500 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

MAXXON CORP — Type Maxxon Standard and Maxxon High Strength

Floor Mat Materials* — (Optional) - Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Type Encapsulated Sound Mat.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping for use with floor mat reinforcement.

Metal Lath — (Optional) 3/8 in. expanded galvanized steel diamond mesh, 3.4 lbs/sq yd loose laid over the floor mat material.

Fiber Glass Reinforcement - (Optional, Not Shown) - 0.015 in. thick PVC coated non-woven fiberglass mesh, 0.368 lbs/sq yd loose laid over the floor mat material.

System No. 5

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Floor - Mineral and Fiber Board* — Min 1/2 in. thick, supplied in sizes ranging from 3 ft by 4 ft to 8 ft by 12 ft. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

HOMASOTE CO — Type 440-32 Mineral and Fiber Board

System No. 6

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.4 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

ELASTIZELL CORP OF AMERICA — Type FF.

System No. 7

Subflooring — Nom 5/8 in. thick wood structural panels, min grade C-D. Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

FORMULATED MATERIALS LLC — Types FR-25, FR-30, SiteMix, and Treadstone Advantage

Alternate Floor Mat Material* — (Optional) Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 1 in.

FORMULATED MATERIALS LLC — Types M1, M2, M3, Elite, Duo, R1, and R2

System No. 8

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

ARCOSA SPECIALTY MATERIALS — AccuCrete® Types NexGen, Green, Prime and PrePour, AccuRadiant®, AccuLevel® Types G40, G50 and SD30

Alternate Floor Mat Material* - (Optional) - Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 1 in.

ARCOSA SPECIALTY MATERIALS — AccuQuiet® Types D13, D-18, D25, DX38, EM.125, EM.125S, EM.250, EM.250S, EM.375, EM.375S, EM.750, and EM.750S.

System No. 9

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) — Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring — Floor Topping Mixture* — Min 1 in. thickness of floor topping mixture having a min compressive strength of 2100 psi. Refer to manufacturer's instructions accompanying the material for specific mix design. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

System No. 10

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the joists with joints staggered.

Vapor Barrier — (Optional) - Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) - Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See Floor- and Roof-Topping Mixtures (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Materials* — (Optional) - Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 11

Subflooring — Min 23/32 in. thick T&G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists. Gypsum board secured with 1 in. long No. 6 Type W bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

Floor Mat Materials* — (As an alternate to the single layer gypsum board) - Floor mat material loose laid over the subfloor.

MAXXON CORP — Type Encapsulated Sound Mat.

Gypsum Board* — (For use when floor mat is used) Two layers of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists on top of the floor mat material. Gypsum board secured to each other with 1 in. long No. 6 Type G bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches in between layers and from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

System No. 12

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) — Nom 0.030 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

DEPENDABLE LLC — GSL M3.4, GSL K2.6, GSL-CSD and GSL RH

Floor Mat Materials* — (Optional) - Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) - Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 13

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Finish Flooring* — Floor Topping Materials — Min 3/4 in. to 1-1/2 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance with a minimum compressive strength of 1500 psi.

See **Floor- and Roof-Topping Mixtures** (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Materials* — (Optional) — Floor mat material nom 1/8 in. to 3/4 in. thick. Loose laid over the subfloor. When used, Acousti-flor CSM (crack suppression mat) is loose laid over the floor mat material. Floor topping material thickness is dependent on thickness of floor mat used.

WALFLOR INDUSTRIES INC — Type Acousti-flor, Acousti-flor CSM. Floor topping thickness depends on products used as follows:

Acousti-flor (1/8 in. thick) - Floor topping thickness shall be a minimum of 3/4 in.

Acousti-flor (1/4 in. thick) - Floor topping thickness shall be a minimum of 1 in.

Acousti-flor (3/8 in. thick) - Floor topping thickness shall be a minimum of 1 in.

Acousti-flor (3/4 in. thick) - Floor topping thickness shall be a minimum of 1-1/2 in.

Metal Lath — (Optional) — Expanded steel diamond mesh, 2.5 lb / sq yd loose laid over floor mat material.

Fiberglass Mesh Reinforcement — (Optional) — Coated non-woven glass fiber mesh grid loose laid over floor mat material.

System No. 14

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Finish Flooring - Floor Topping Mixture* — Min 1 in. thickness of floor topping mixture having a min compressive strength of 4500 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

SIKA DEUTSCHLAND GMBH — Type SCHONOX AP Rapid Plus

System No. 15

Subflooring — Nom 5/8 in. thick wood structural panels, min grade "C-D". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered. Plywood or panels secured to trusses with No. 6d cement coated nails spaced 6 in. OC at end joints and 10 in. OC along the remainder of the joists. Nails spaced 1/2 in. from side and end joints.

Vapor Barrier — (Optional) - Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) - Nom 0.010 in. thick commercial asphalt saturated felt.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See Floor- and Roof-Topping Mixtures (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Materials* — (Optional, Not Shown) - Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

Freudenberg Performance Materials LP — EnkaSonic® by Colbond a member of the Low & Bonar group Types 125, 250, 250 Plus, 400, 400 Plus, 750, and 750 Plus.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping for use with floor mat reinforcement.

Metal Lath — (Optional) — Expanded steel diamond mesh, 2.5 lb / sq yd loose laid over floor mat material.

Fiberglass Mesh Reinforcement — (Optional) — Coated non-woven glass fiber mesh grid loose laid over floor mat material.

2. **Wood Joists** — Min 2 by 10, spaced 16 in. OC and effectively fireblocked in accordance with local codes.

3. **Cross Bridging** — Min 1 by 3 in. or min 2 by 10 solid blocking from side and end joints.

3A. **Horizontal Bridging** — Used in lieu of Item 3 in same joist bay as ceiling damper (Item 4), when ceiling damper is employed. Wood 2 by 4 in. secured between joists with nails.

4. **Ceiling Damper*** — (Optional) - Max nom area shall be 198 sq in. Max rectangular size shall be 12 in. wide by 16-1/2 in. long. Max height of damper shall be 8-3/4 in. Aggregate damper openings shall not exceed 99 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 8) shall be installed in accordance with installation instructions.

AIR BALANCE INC — Type 299 (See Item 6A)

AIR KING VENTILATION PRODUCTS — Series FRAS, Series FRAK, Series FRAKV

CENTRAL VENTILATION SYSTEMS CO L L C — Models C-S/R-HC(-A), C-RD-HC(-A)

JAMIL ALI NASSER AL-ZADJALI FOR INDUSTRY — Models C-S/R-HC(-A), C-RD-HC(-A)

BADR & ASFOUR COMPANY FOR ENGINEERING AND METAL INDUSTRIES — Models C-S/R-HC(-A), C-RD-HC(-A)

GREENHECK FAN CORP — Model CRD-1WJ

METAL-FAB INC — Models MSCDHC, MRCDHC

BRISK MFG INC — Model BMI-50-CRD-S/R-WT

PRICE INDUSTRIES LTD — Models CD-S/R-HC, CD-RD-HC

RUSKIN COMPANY — Model CFD7

UNITED ENERTECH CORP — Models C-S/R-HC(-A), C-RD-HC(-A)

5. **Resilient Channels** — (Optional, Not Shown) - Nom 1/2 in. deep resilient channels, formed of No. 25 MSG galv steel and shaped as shown, spaced 24 in. OC perpendicular to joists. Channels overlapped at splice 4 in. at ends and secured to each joist with one 1-1/4 in. long Type S bugle head screw. Additional resilient channels positioned so as to coincide with end joints of gypsum board (Item 6). Additional channels shall extend min 3 in. beyond each side edge of board.

5A. **Steel Framing Members*** — (Optional, Not Shown) - As an alternate to Item 5, 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 joists. Channels secured to joists as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to joists (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to alternating joists with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to alternating joists with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for

use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 6.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75).

5B. Steel Framing Members* — (Optional, Not Shown) - As an alternate to Item 5, 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 joists. Channels secured to joists as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to joists (Item 2). Clips spaced 48 in. OC. GenieClips secured to alternating joists with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. Furring channels are friction fitted into clips. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 6.

PLITEQ INC — Type GENIECLIP

5C. Alternate Steel Framing Members* — (Not Shown) - As an alternate to item 5, furring channels and Steel Framing Members as described below.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-5/8 in. wide by 7/8 in deep, spaced 24 in OC, perpendicular to joists. Channels secured to joists as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the wood joists (Item 2). Clips spaced at 48" OC and secured to the bottom of the joists with one 2 in. Coarse Drywall Screw with 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire. Additional clips are required to hold the Gypsum Butt joints as described in item 6.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

5D. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 5.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC, perpendicular to the joists. Channels secured to Cold Rolled Channels at every intersection with a 3/4 in. TEK screw through each furring channel leg. Ends of adjoining channels overlapped 12 in. and fastened together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap, or with two 3/4 in. TEK screws in each leg of the overlap section. Two furring channels positioned 3 in. OC, 1-1/2 in. on each side of gypsum board (Item 6) end joints, each extending a min of 6 in. beyond both side edges of the board.

b. **Cold Rolled Channels** — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to joists, friction-fitted into the channel caddy on the Steel Framing Members (Item 5Dc) and secured with two 3/4 in. TEK screws. Adjoining lengths of cold rolled channels lapped min. 12 in. and secured along bottom legs with four 3/4 in. TEK screws and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. **Steel Framing Members*** — Spaced 48 in. OC. max along joist, and secured to the joist on alternating joists with two, #10 x 1-1/2 in. screws through mounting holes on the hanger bracket.

PAC INTERNATIONAL L L C — Type RSIC-SI-CRC EZ Clip

5E. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 5.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to joists and friction fit into Steel Framing Members (Item 5Eb). Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap or with two TEK screws along each leg of the 6 in. overlap. Two furring channels positioned 6 in. OC, 3 in. on each side of gypsum board (Item 6) end joints. Butt joint channels held in place by strong back channels placed upside down, on top of, and running perpendicular to primary furring channels, extending 6 in. longer than length of gypsum side joint. Strong back channels spaced maximum 48 in. OC. Strong back channels secured to every intersection of primary furring channels with four 7/16 in. pan head screws, two along each of the legs at intersections. Butt joint channels run

perpendicular to strong back channels and shall be minimum 6 in. longer than length of joint, secured to strong back channels with 7/16 in. pan head screws, two along each of the legs at intersection with strong back channels.

b. **Steel Framing Members*** — Used to attach furring channels (Item 5Ea) to joists. Clips spaced 48 in. OC and secured along joist webs at each furring channel intersection with min. 3/4 in. long self-drilling #10 x 1-1/2 in. screws through each of the provided hole locations. Furring channels are friction fitted into clips.

PAC INTERNATIONAL L L C — Type RSIC-S1-1 Ultra

5F. **Steel Framing Members*** — (Optional - Not Shown) — Used to attach resilient channels (Item 5) to joists (Item 2). Clips spaced 48 in. OC and secured to joists with one No. 8 x 2-1/2 in. coarse drywall screw through center grommet hole. Channels secured to clips with one #10 x 1/2 in. pan-head self-drilling screw. Ends of adjoining channels overlapped 6 in. and secured together with two #8 15 x 1/2 in. Philips Modified screws spaced 2-1/2 in. from the center of the overlap. Gypsum board butt joints require additional resilient channels spaced 1-1/2 in. from the butt joint on either side. One edge of the extra channels will extend to an adjacent joist where it is secured with a clip.

KEENE BUILDING PRODUCTS CO INC — Type RC+ Assurance Clip

5G. **Steel Framing Members*** — (Optional, Not Shown) — Used as an alternate method to attach resilient channels to structural members. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and spaced max 16 in. O.C. Channel ends butted and centered under the structural members and attached with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the structural members with the screws supplied with the accessory and per the accessory manufacturer's installation instructions. Gypsum Board butt joints spaced minimum 24 in. OC and Gypsum Board screws spaced 8 in. OC when used.

PAC INTERNATIONAL L L C — Types RC-1 Boost

6. **Gypsum Board*** — Nom 5/8 in. thick, 4 ft wide gypsum board. When resilient channels (Item 5) are used, gypsum board installed with long dimension perpendicular to resilient channels and the side edges of the board located between joists. Gypsum board fastened to resilient channels with 1-1/4 in. long Type S bugle head screws spaced 12 in. OC. End joints of gypsum board similarly fastened to additional resilient channels positioned at end joint locations. Screw located 3/4 in. from sides and 1/2 in. from ends of gypsum board sheets. When resilient channels (Item 5) are not used, the gypsum board shall be installed with long dimension perpendicular to wood joists. Screw located 3/4 in. from sides and 1/2 in. from ends of gypsum board sheets. When **Steel Framing Members*** (Item 5A, 5B) are used, gypsum board installed with long dimension perpendicular to furring channels and side joints of sheet located beneath joists. Gypsum board screws are driven through channel spaced 12 in. OC in the field. Gypsum board butt joints shall be staggered min 2 ft. within the assembly, and occur between the main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels shall be spaced approximately 3-1/2 in. OC, and be attached to the joist with one clip at each end of the channel. Screw spacing along the butt joint to attach the wallboard to the furring channels shall be 8 in. OC. When **Steel Framing Members*** (Item 5C) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Additional screws shall be placed in the adjacent section of gypsum board into the aforementioned 3 in. extension of the extra butt joint channels as well as into the main channel that runs between. Butt joint furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel.

When **Steel Framing Members** (Item 5D) are used, nom 5/8 in. thick, 4 ft wide gypsum board, installed as described in Item 6. Adjacent butt joints staggered minimum 48 in. OC.

When **Steel Framing Members** (Item 5E) are used, nom 5/8 in. thick, 4 ft wide gypsum board, installed as described in Item 6. Butt joints staggered minimum 24 in. OC.

AMERICAN GYPSUM CO — Type AG-C.

CERTAINTED GYPSUM INC — Type C.

CGC INC — Type C, IP-X2.

CERTAINTED GYPSUM INC — Type LGFC-C/A.

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C.

NATIONAL GYPSUM CO — Types eXP-C, FSK-C, FSW-C, FSW-G.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C.

THAI GYPSUM PRODUCTS PCL — Type C.

UNITED STATES GYPSUM CO — Type C, IP-X2.

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Type C, IP-X2.

6A. **Gypsum Board*** — (Finish Rating - 16 min.) Required when Air Balance Inc. Type 299 ceiling damper (Item 4) is installed. Nom 5/8 in. thick, 48 in. wide gypsum board, installed and secured as described in item 6.

UNITED STATES GYPSUM CO — Type C

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Type C

6B. **Gypsum Board* (As an alternative to Items 6 and 6A)** — Nom 5/8 in. thick, 48 in. wide gypsum board, installed and secured as described in Items 6 and 6A with max screw spacing 8 in. OC.

CGC INC — Type ULIX

UNITED STATES GYPSUM CO — ULIX

7. **Finishing System** — (Not Shown) - Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

8. **Grille** — Steel grille, installed in accordance with the installation instructions provided with the ceiling damper.

9. **Discrete Products Installed in Air-handling Spaces*** — Automatic Balancing Valve/Damper — (Not Shown - Optional) — For use with item 4, Ruskin Company's Model CFD7 damper (CABS). Ceiling damper to be provided with plenum box per damper manufacturer's instructions with side outlet only. Entire assembly to be installed into any UL Class 0 or Class 1 flexible air duct in accordance with the instructions provided by the automatic balancing valve/damper manufacturer.

METAL INDUSTRIES INC — Model ABV-4, ABV-5, ABV-6

*** 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 2024-09-02

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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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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

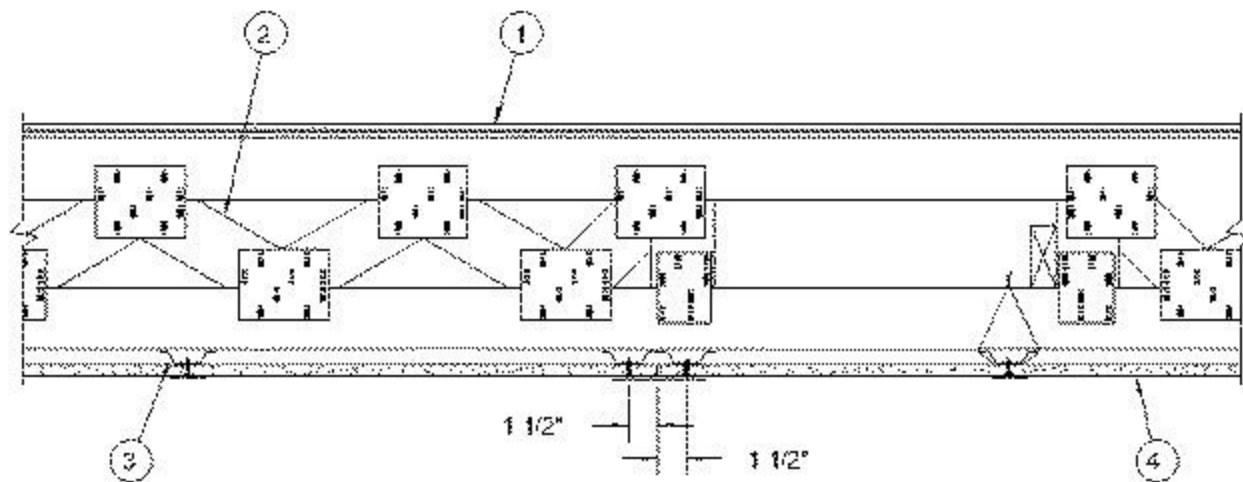
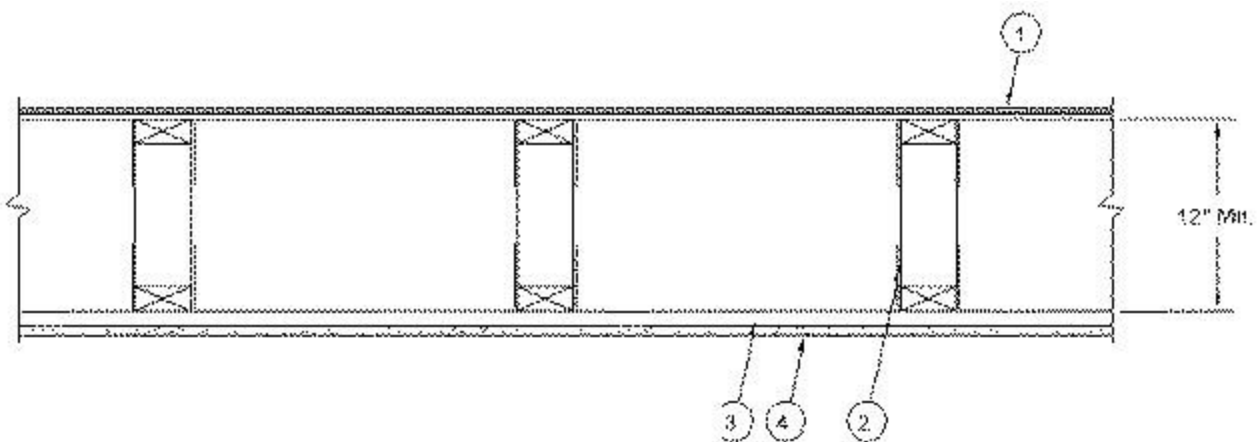
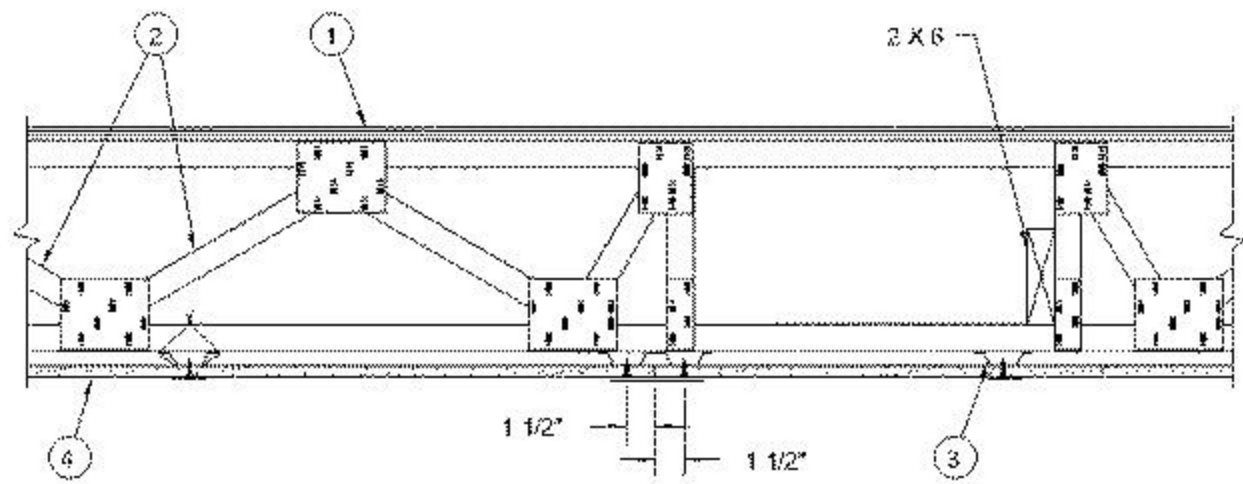
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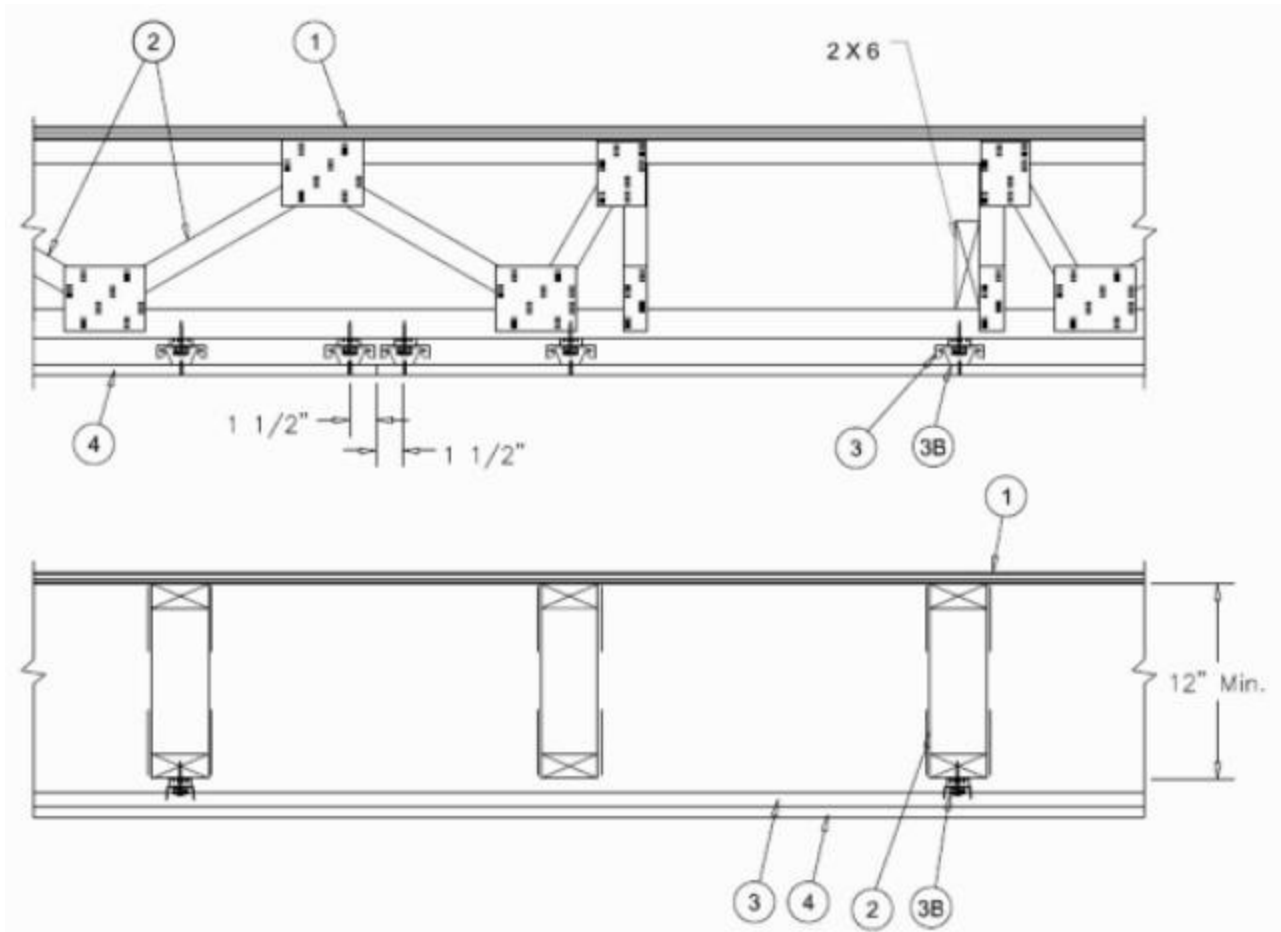
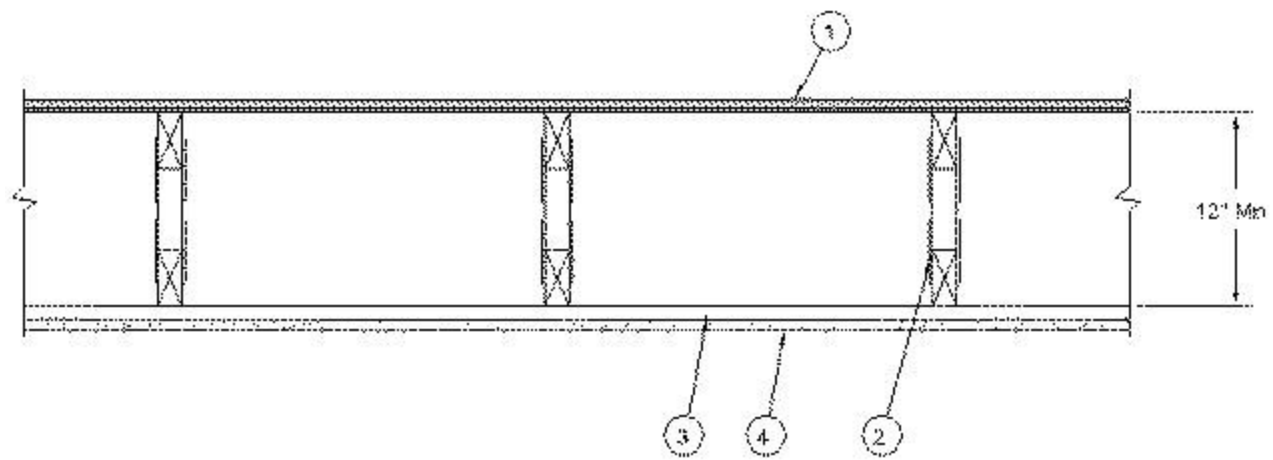
September 2, 2024

Unrestrained Assembly Rating - 1 Hr.**Finish Rating - 22 Min.**

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. **Flooring System** — The flooring system shall consist of one of the following:

System No. 1

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

System No. 2

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring — Min 3/4 in. thickness of lightweight insulating concrete with **Perlite Aggregate*** or **Vermiculite Aggregate***, or gypsum concrete.

See **Perlite Aggregate** (CFFX) and **Vermiculite Aggregate** (CJZZ) categories for names of manufacturers.

System No. 3

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Floor Mat Materials* — (Optional)— Floor mat material nom 5/64 in. (2 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1 in. of floor-topping mixture.

HACKER INDUSTRIES INC — Type Hacker Sound-Mat.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick adhered to subfloor with Hacker Floor Primer. Primer to be applied to the surface of the mat prior to the placement of a min 1-1/4 in. (32 mm) of floor-topping mixture.

HACKER INDUSTRIES INC — Type Hacker Sound-Mat II.

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/8 in. (3 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 3/4 in. (19 mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 125

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 1/4 in. (6 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1 in. (25 mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 250, Quiet Qurl 55/025

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/8 in. (10 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/4 in. (32 mm)

HACKER INDUSTRIES INC — FIRM-FILL SCM 400, Quiet Qurl 60/040

Alternate Floor Mat Materials — (Optional) — Floor mat material nom 3/4 in. (19 mm) thick loose laid over the subfloor. Floor topping thickness shall be a min of 1-1/2 in. (38 mm)

HACKER INDUSTRIES INC — Type FIRM-FILL SCM 750, Quiet Qurl 65/075

Metal Lath — (Optional) — For use with 3/8 in. (10 mm) floor mat materials, 3/8 in. expanded steel diamond mesh, 3.4 lbs/sq yd placed over the floor mat material. Hacker Floor Primer to be applied prior to the placement of the metal lath. When metal lath is used, floor topping thickness a nom 1-1/4 in. over the floor mat.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1100 psi. Mixture shall consist of 6.8 gal of water to 80 lbs of floor topping mixture to 1.9 cu ft of sand.

HACKER INDUSTRIES INC — Firm-Fill Gypsum Concrete, Firm-Fill 2010, Firm-Fill 3310, Firm-Fill 4010, Firm-Fill High Strength, Gyp-Span Radiant

System No. 4

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.010 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1800 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

UNITED STATES GYPSUM CO — Types LRK, HSLRK, CSD

LATICRETE SUPERCAP L L C — Types LRK, HSLRK

USG MEXICO S A DE C V — Types LRK, HSLRK, CSD

Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

UNITED STATES GYPSUM CO — Types SAM, LEVELROCK® Brand Sound Reduction Board, LEVELROCK® Brand Floor Underlayment SRM-25

Alternate Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding minimum thickness of floor topping over floor mat.

GRASSWORX L L C — SC Types

Alternate Floor Mat Material* — (Optional) - Floor mat material nominal 3/8 in. thick loose laid over the subfloor. Floor topping shall be a min 3/4 in. thick.

System No. 5

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.4 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

ELASTIZELL CORP OF AMERICA — Type FF

System No. 6

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 1-1/2 in. thickness of floor topping mixture having a min compressive strength of 1000 psi and a cast density of 100 plus or minus 5 pcf. Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mixture shall consist of 1.2 cu feet of preformed foam concentrate to 94 lbs Type I Portland cement, 300 lbs of sand with 5-1/2 gal of water.

AERIX INDUSTRIES — Floor Topping Mixture

System No. 7

Deleted.

System No. 8

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a minimum compressive strength of 1500 psi. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Types Maxxon Standard and Maxxon High Strength

Floor Mat Materials* — (Optional) - Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

MAXXON CORP — Type Encapsulated Sound Mat.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping for use with floor mat reinforcement.

Metal Lath — (Optional) - 3/8 in. expanded galvanized steel diamond mesh, 3.4 lbs/sq yd loose laid over the floor mat material.

Fiber Glass Reinforcement - (Optional, Not Shown) - 0.015 in. thick PVC coated non-woven fiberglass mesh, 0.368 lbs/sq yd loose laid over the floor mat material.

System No. 9

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 1000 psi. Mixture shall consist of 5 to 8 gal of water to 80 lbs of floor topping mixture to 2.1 cu ft of sand. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

ULTRA QUIET FLOORS — UQF-A, UQF-Super Blend, UQF-Plus 200

System No. 10

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

FORMULATED MATERIALS LLC — Types FR-25, FR-30, SiteMix, and Treadstone Advantage

Alternate Floor Mat Material* — (Optional) Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in.

FORMULATED MATERIALS LLC — Types M1, M2, M3, Elite, Duo, R1, and R2

System No. 11

Subflooring — Min 1 by 6 in. T & G lumber fastened diagonally to trusses, or min 15/32 in. thick plywood or min 7/16 in. thick oriented strand board (OSB) wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to trusses with joints staggered.

Finish Floor - Mineral and Fiber Board* — Min 1/2 in. thick, supplied in sizes ranging from 3 ft by 4 ft to 8 ft by 12 ft. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

HOMASOTE CO — Type 440-32 Mineral and Fiber Board

System No. 12

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring — Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

ARCOSA SPECIALTY MATERIALS — AccuCrete® Types NexGen, Green, Prime and PrePour, AccuRadiant®, AccuLevel® Types G40, G50 and SD30

Alternate Floor Mat Material* — (Optional) — Floor mat material nominal 2 - 9.5 mm thick loose laid over the subfloor. Floor topping shall be a min of 3/4 in.

ARCOSA SPECIALTY MATERIALS — AccuQuiet® Types D13, D-18, D25, DX38, EM.125, EM.125S, EM.250, EM.250S, EM.375, EM.375S, EM.750, and EM.750S.

System No. 13

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the joists with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See **Floor- and Roof-Topping Mixtures** (CCOX) category for names of Classified Companies.

Floor Mat Materials* — (Optional) — Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 14

Subflooring — Min 23/32 in. thick T&G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists. Gypsum board secured with 1 in. long No. 6 Type W bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

Floor Mat Materials* — (As an alternate to the single layer gypsum board) — Floor mat material loose laid over the subfloor.

MAXXON CORP — Type Encapsulated Sound Mat.

Gypsum Board* — (For use when floor mat is used) Two layers of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to joists on top of the floor mat material. Gypsum board secured to each other with 1 in. long No. 6 Type G bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. The joints of the gypsum board are to be staggered a minimum of 12 inches in between layers and from the joints of the subfloor.

GEORGIA-PACIFIC GYPSUM L L C — Type DS

System No. 15

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping having a min compressive strength of 1000 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

DEPENDABLE LLC — GSL M3.4, GSL K2.6, GSL-CSD, GSL RH and SKIMFLOW

Floor Mat Materials* — (Optional) — Nom. 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 55/025 and Quiet Qurl 55/025 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 60/040 and Quiet Qurl 60/040 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 65/075, Quiet Qurl 65/075 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

KEENE BUILDING PRODUCTS CO INC — Type Quiet Qurl 52/013 and Quiet Qurl 52/013 N

Alternate Floor Mat Materials* — (Optional) — Floor mat material Nom. 1/4 in. entangled net core with a compressible fabric attached to the bottom loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

KEENE BUILDING PRODUCTS CO INC — Quiet Qurl 55/025 MT and Quiet Qurl 55/025 N MT

System No. 16

Subflooring — Min 23/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the joists with joints staggered.

Vapor Barrier — (Optional) — Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) — Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See **Floor- and Roof-Topping Mixtures** (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Materials* — (Optional) — Nom 3/32 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat RST02

Floor Mat Materials* — (Optional) — Nom 3/16 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat FF03NP

Floor Mat Materials* — (Optional) — Nom 1/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 3/4 in.

PLITEQ INC — Type GenieMat FF06

Floor Mat Materials* — (Optional) — Nom 3/8 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1 in.

PLITEQ INC — Type GenieMat FF10

Floor Mat Materials* — (Optional) — Nom 3/4 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

PLITEQ INC — Type GenieMat FF17

Floor Mat Materials* — (Optional) — Nom 1 in. thick loose laid over the subfloor. Floor topping thickness shall be a minimum of 1-1/2 in.

PLITEQ INC — Type GenieMat FF25

System No. 17

Subflooring — Nom. 1-1/2 in. thick T & G laminated composite plywood sub-floor panels to be perpendicular to the trusses with end joints staggered 4 ft. End joints centered over top chord of trusses. Subfloor panels secured to trusses with construction adhesive and #8 by 3 in. wood screws spaced 12 in. OC in the field and 6 in. OC at the end joints.

RSP INDUSTRIES INC — SAP board

System No. 18

Subflooring — Min 15/32 in. thick wood structural panels, min grade "Underlayment" or "Single-Floor". Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss.

Wall and Partition Facings and Accessories* - Sound Barrier (Optional) — Acoustic Sleeper pads stapled to the top of the subfloor, the bottom of the finish floor, or to 5/16 in. thick by 1-1/2 in. wide wood strips and centered over wood trusses. Acoustic Sleeper pads are to be spaced appropriately so that the finish floor panels are fastened through Acoustic Sleeper pads to the trusses.

STC ARCHITECTURAL PRODUCTS L L C DBA STC SOUND CONTROL — Acoustic Sleeper

Finish Floor — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Butt joints of panels have the option of being sealed with any UL Classified caulk or sealant found under - Fill, Void or Cavity Materials* (XHHW).

System No. 19

Structural Cement-Fiber Units* — For use with **UNITED STATES GYPSUM CO** Types C, IP-X2, IPC-AR and ULIX or **AMERICAN GYPSUM CO** Type AG-C. gypsum boards only. Nom 3/4 in. thick, with long edges tongue and grooved. Long dimension of panels to be perpendicular to wood trusses with end joints staggered a min of 2 ft and centered over the trusses. Panels secured to wood trusses with 1-5/8 in. long, No. 8, self- countersinking wood screw spaced a max of 12 in. OC in the field with a screw located 1 in. and 2 in. from each edge, and 8 in. OC on the perimeter with a screw located 2 in. from each edge, located 1/2 in. from the end edges of the panel.

UNITED STATES GYPSUM CO — Types STRUCTO-CRETE, USGSP

System No. 20

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Finish Flooring - Floor Topping Mixture* — Min 1 in. thickness of floor topping mixture having a min compressive strength of 4500 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

SIKA DEUTSCHLAND GMBH — Type SCHONOX AP Rapid Plus

System No. 21

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in.

diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Vapor Barrier — (Optional) - Commercial asphalt saturated felt, 0.030 in. thick.

Vapor Barrier — (Optional) - Nom 0.010 in. thick commercial rosin-sized building paper.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See Floor- and Roof-Topping Mixtures (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Materials* — (Optional, Not Shown) - Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

Freudenberg Performance Materials LP — EnkaSonic® by Colbond a member of the Low & Bonar group Types 125, 250, 250 Plus, 400, 400 Plus, 750, and 750 Plus.

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping for use with floor mat reinforcement.

Metal Lath — (Optional) — Expanded steel diamond mesh, 2.5 lb / sq yd loose laid over floor mat material.

Fiberglass Mesh Reinforcement — (Optional) — Coated non-woven glass fiber mesh grid loose laid over floor mat material.

System No. 22

Subflooring — Min 23/32 in. thick T & G wood structural panels described and installed as shown in System No. 1.

Finish Floor - Building Units* — Min 1/2 in. thick magnesium oxide panels installed parallel, perpendicular, or diagonally to trusses with panel edges offset a min of 4 in. between subfloor and magnesium oxide panels. Panels secured to subfloor with construction adhesive and corrosion resistant fasteners, spaced 12 in. OC around the perimeter and in the field of the panel. Fasteners must be placed no closer than 1/2 in. from all panel edges and no closer than 2 in. from panel corners

HUBER ENGINEERED WOODS L L C — Type 1/2 in. Square Edge Exacor™ Board

System No. 23

Subflooring — Min 15/32 in. thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with joints staggered. Fastened with 8d ringed shank nails spaced 12 in. OC along each truss.

Finish Floor - Building Units* — Min 1/2 in. thick, supplied in 4 by 8 ft panels, fastened to trusses through subfloor with 8d ringed shank nails spaced a max of 12 in. OC. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

ECTEK INTERNATIONAL INC — Type MegaBoard, 1/2 in. thick

System No. 24

Subflooring — Building Units* — Nom 3/4 in. thick, tongue and grooved boards. Long dimension of boards to be perpendicular to wood trusses with end joints staggered a min of 4 ft. and centered over the trusses. Boards secured to trusses with min 2 in. long screws or 2 in. x 0.113 in. Ring Shank nails spaced a max of 12 in. OC in the field with screws/nails located 1 in. from long edge, and max 8 in. OC along the end joints with screws/nails located 1/2 in. from end joint.

ECTEK INTERNATIONAL INC — Type MegaBoard, 3/4 in. thick

Finish Floor (optional) — Building Units* — Min 1/2 in. thick, supplied in 4 by 8 ft panels, fastened to trusses through subfloor with 2-3/8 in. long 8d ringed shank nails spaced a max of 12 in. OC. All joints to be staggered a min of 12 in. with adjacent sub-floor joints.

ECTEK INTERNATIONAL INC — Type MegaBoard, 1/2 in. thick

System No. 25

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Vapor Barrier — (Optional) — Nom 0.030 in. thick commercial asphalt saturated felt.

Floor Mat Materials* — (Optional) — Floor mat material loose laid over the subfloor. Refer to manufacturer's instructions regarding the minimum thickness of floor topping over each floor mat material.

GRASSWORX L L C — SC Types

Finish Flooring* — Min 3/4 in. thickness of any Floor Topping Mixture bearing the UL Classification Marking as to Fire Resistance. See Floor- and Roof-Topping Mixtures (CCOX) category for names of Classified Companies. Refer to the manufacturer's instructions accompanying the material and/or contact the manufacturer's technical support for specific mix design and minimum thickness recommended for use with eligible floor mat(s).

Floor Mat Reinforcement — (Optional) - Refer to manufacturer's instructions regarding minimum thickness of floor topping for use with floor mat reinforcement.

Metal Lath — (Optional) — Expanded steel diamond mesh, 2.5 lb / sq yd loose laid over floor mat material.

Fiberglass Mesh Reinforcement — (Optional) — Coated non-woven glass fiber mesh grid loose laid over floor mat material.

System No. 26

Subflooring – Building Units* — Nom 3/4 in. thick, ship-lap or tongue-in-groove edge detail. Long dimension of boards to be perpendicular to trusses with end joints staggered a min of 4 ft. and centered over the trusses. Boards secured to trusses with #8 x 2 in. long screws or 2 in. long by 0.113 in. ring shank nails spaced a max of 12 in. OC in the field and 8 in. OC along butt ends. Fasteners located 1/2 in. from butt edges and 2 in. from long edges of the board. When Finish Floor (see below) is not used, must be used with Item 7I).

AMERIFORM L L C — Type Nocom

Finish floor – (Optional) - Min 1/2 in. thick, supplied in 4 ft by 8 ft panels, installed perpendicular or parallel to trusses with panel edges offset a min of 24 in. with adjacent sub-floor joints. Panels secured to subfloor with construction adhesive and corrosion resistant fasteners spaced a max of 12 in. OC. around perimeter and in the field of the panel. Fasteners located 1/2 in. at butt edges and 2 in. from long edge of the boards.

MULTI-PANELS – Type M4 Panel

System No. 27

Subflooring Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Finish Floor – Building Units* - (Optional) - Min 1/2 in. thick, supplied in 4 ft by 8 ft panels, installed perpendicular or parallel to trusses with panel edges offset a min of 24 in. with adjacent sub-floor joints. Panels secured to subfloor with construction adhesive and corrosion resistant fasteners spaced a max of 12 in. OC. around perimeter and in the field of the panel. Fasteners located 1/2 in. at butt edges and 2 in. from long edges of the board.

MULTI-PANELS – Type M4 Panel

System No. 28

Subflooring — Min 23/32 in. thick T & G wood structural panels, min grade "Underlayment" or "Single-Floor". Face grain of plywood or strength axis of panels to be perpendicular to the trusses with end joints staggered 4 ft. Panels secured to trusses with construction adhesive and No. 6d ringed shank nails spaced 12 in. OC along each truss. TetraGRIP™ nails measuring 2-3/8 in. long, 0.113 in. diameter, 0.272 in. round head, and helically threaded shank with barbed features on the helix meeting ASTM F1667 and having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

Finish Flooring - Floor Topping Mixture* — Min 3/4 in. thickness of floor topping mixture having a min compressive strength of 900 psi. Refer to manufacturer's instructions accompanying the material for specific mix design.

TECNODRY SA DE CV — Type SURFACE GYP

2. **Trusses** — Parallel chord trusses, spaced a max 24 in. OC, fabricated from nom 2 by 4 in. lumber with lumber oriented vertically or horizontally. Min truss depth is 12 in. when item 9 is not employed. Min truss depth is 18 in. when item 9 is employed. Truss members secured together with min No. 20 MSG galv steel truss plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split-tooth-type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approx 7/8 in. centers with four rows of teeth per in. of plate width.

3. **Furring Channels** — Hat channels, 7/8 in. deep by 2-9/16 in. or 2-11/16 in. or 2-23/32 in. wide at the base and 1-7/16 in. wide at the face, formed from No. 25 ga galv steel, spaced 24 in. OC perpendicular to trusses. Channels secured to trusses with double strand of No. 18 SWG galv steel wire spaced 48 in. OC. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Two furring channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board.

3A. **Resilient Channels** — (Not Shown) — As an alternate to Item 3, resilient channel formed from No. 26 MSG galv steel, spaced 16 in. OC perpendicular to trusses. Channels secured to each truss with 1-1/4 in. long No. 6 Type S bugle head steel screw. Channels overlapped at splices 4 in. Two resilient channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board.

3B. **Steel Framing Members*** — (Optional)— Used as an alternate method to attach furring channels to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to the bottom chord of alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to the bottom chord of alternating trusses with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item 3. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two min 7/16 in. long No. 6 self-tapping framing screws, at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. When Fiber, Sprayed (Item 6) is used, furring channel spacing reduced to 16 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board shall be installed as described in Item 4.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75)

3C. **Steel Framing Members*** — (Optional, Not Shown) — Used as an alternate method to attach furring channels to trusses. Clips spaced 48 in. OC., and secured to the bottom chord to alternating trusses 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. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. Two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 6. When Item 3C is used and Batts and Blankets* are added per Section III Item 18 Blanket Insulation in the General Information of this Directory (BXUV), clips spaced 48 in. OC, furring channels spaced 16 in. OC max, 3-1/2 in. max. Batts and Blankets* secured to plywood subfloor with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC, and two layers of gypsum board required as described in Item 4A. When the Batts and Blankets* are draped over the furring channel/gypsum panel ceiling membrane, the clip spacing shall be reduced to 24 in. OC and secured to consecutive trusses, the furring channel spacing shall be reduced to 12 in. OC, and two layers of gypsum board required as described in Item 4A.

KINETICS NOISE CONTROL INC — Type Isomax.

3D. **Steel Framing Members*** — (Optional, Not Shown) — For Use with Item 7- Used as an alternate method to attach furring channels to trusses. Clips spaced 48 in. OC. and secured to the bottom chord to alternating trusses with one No. 8 x 2-1/2 in. coarse

drywall screw through the center hole. Furring channels are friction fitted into clips. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. Not evaluated for use with Item 6.

PLITEQ INC — Type Genie Clip

3E. Steel Framing Members* — (Optional, Not Shown) — For use with Item 7B - Used as an alternate method to attach furring channels to trusses. Clips spaced at 48" OC and secured to the bottom of the trusses with one 2 in. Coarse Drywall Screw with 1 in. diam. washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire. Additional clips are required to hold the Gypsum Butt joints as described in item 4. Not evaluated for use with Item 6.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

3F. Resilient Channels — For use with Item 4B and 7A - Resilient channels, formed from No. 25 MSG galv steel and shaped as shown, spaced 12 in. OC perpendicular to joist. Channels overlapped 4 in. at splices and secured to each joist with 1-1/4 in. Type S screws. Min end clearance of channels to wall to be 1/2 in. Additional resilient channels positioned so as to coincide with end joints of gypsum board.

3G. Resilient Channels — For Use With Item 4C and 7C. Formed from min 25 MSG galv steel installed perpendicular to trusses and spaced 16 in. OC. Channels secured to each truss with 1-5/8 in. long Type S bugle head steel screws. Channels overlapped 4 in. at splices. Two channels, spaced 6 in. OC, oriented opposite each gypsum panel end joint. Additional channels shall extend min 6 in. beyond each side edge of panel. Insulation, Item 7C is applied over the resilient channel/gypsum panel ceiling membrane.

3H. Steel Framing Members* — (Optional, Not Shown) — Used as an alternate method to attach furring channels to trusses. Clips spaced at 48" OC and secured to the bottom of the trusses with one 2-1/2 in. Coarse Drywall Screw with 1 in. diam. washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire. Additional clips are required to hold the Gypsum Butt joints as described in item 4. Not evaluated for use with Item 6.

REGUPOL AMERICA — Type SonusClip

3I. Steel Framing Members — (Not Shown) — For use with Items 4C and 7F, As an alternate to Item 3, main runners, cross tees, cross channels and wall angle as listed below.

a. **Main Runners** — Nom 10 or 12 ft long, 15/16 in. or 1-1/2 in. wide face, spaced 4 ft. OC. Main runners suspended by min 12 SWG galv. steel hanger wires spaced 48 in. OC. Hanger wires to be located adjacent to main runner/cross tee intersections. Hanger wires wrapped and twist-tied on 16d nails driven in to side of trusses at least 5 in. above the bottom face.

b. **Cross Tees or Channels** — Nom 4 ft long cross tees, with 15/16 in. or 1-1/2 in. wide face, or nom 4 ft long cross channels, with 1-1/2 in. wide face, spaced 16 in. OC, installed perpendicular to the main runners. Additional cross tees or channels used 8 in. from each side of butted gypsum board end joints. The cross tees or channels may be riveted or screw-attached to the wall angle or channel to facilitate the ceiling installation.

c. **Wall Angle or Channel** — Painted or galv. steel angle with 1 in. legs or channel with 1 in. legs, 1-9/16 in. deep attached to walls at perimeter of ceiling with fasteners 16 in. OC. To support steel framing member ends and for screw-attachment of the gypsum panel.

USG INTERIORS LLC — Type DGL or RX

3J. Steel Framing Members* — (Optional, Not Shown) — Used to attach resilient channels (Item 3A) to trusses (Item 2). Clips spaced 48 in. OC on adjacent trusses, and secured to trusses with one No. 8 x 2-1/2 in. coarse drywall screw through center grommet hole. Channels secured to clips with one #10 x 1/2 in. pan-head self-drilling screw. Ends of adjoining channels overlapped 6 in. and secured together with two #8 15 x 1/2 in. Philips Modified Truss screws spaced 2-1/2 in. from the center of the overlap. Gypsum board butt joints require additional resilient channels spaced 1-1/2 in. from the butt joint on either side. One edge of the extra channels will extend to an adjacent truss where it is secured with a clip.

KEENE BUILDING PRODUCTS CO INC — Type RC+ Assurance Clip

3K. Resilient Channels — For use with items 3L, 4F, and 7G — Formed from min 26 MSG galv steel installed perpendicular to trusses. When Item 7G is draped over channels, channels spaced a maximum 12 in. OC. Channels secured to each truss as described in Item 3L.

Channel ends butted and centered under the joists and attached to the joists with one screw at each end. Additional resilient channels positioned so as to coincide with end joints of gypsum board as shown in the above illustration. Additional channels shall extend min 3 in. beyond each side edge of board.

3L. Steel Framing Members* — (Optional, Not Shown) — Used as an alternate method to attach resilient channels to joists (Item 2). For use with items 3K, 4F and 7G. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and spaced max 24 in. O.C. Channel ends butted and centered under the joists and attached to the joists with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints, as described in Item 3K. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the joists with the screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Types RC-1 Boost

3M. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 3.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC, perpendicular to trusses. Channels secured to Cold Rolled Channels at every intersection with a 3/4 in. TEK screw through each furring channel leg. Ends of adjoining channels overlapped 12 in. and fastened together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap, or with two 3/4 in. TEK screws in each leg of the overlap section. Two furring channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board.

b. **Cold Rolled Channels** — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to trusses, friction-fitted into the channel caddy on the Steel Framing Members (Item 3Md) and secured with two 3/4 in. TEK screws. Adjoining lengths of cold rolled channels lapped min. 12 in. and secured along bottom legs with four 3/4 in. TEK screws and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 12 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the trusses at the top and bottom of the blocking at each Steel Framing Member (Item 3Md) location with 16d nails or minimum 2-1/2 in. screws.

d. **Steel Framing Members*** — Spaced 48 in. OC. max along truss, and secured to the truss on alternating trusses with two, #10 x 1-1/2 in. screws through mounting holes on the hanger bracket.

PAC INTERNATIONAL L L C — Type RSIC-SI-CRC EZ Clip

3N. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 3.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to trusses and friction fit into Steel Framing Members (Item 3Nc). Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap or with two TEK screws along each leg of the 6 in. overlap. Two furring channels used at end joints of gypsum board (Item 4). Butt joint channels held in place by strong back channels placed upside down, on top of, and running perpendicular to primary furring channels, extending 6 in. longer than length of gypsum side joint. Strong back channels spaced maximum 48 in. OC. Strong back channels secured to every intersection of primary furring channels with four 7/16 in. pan head screws, two along each of the legs at intersections. Butt joint channels run perpendicular to strong back channels and shall be minimum 6 in. longer than length of joint, secured to strong back channels with 7/16 in. pan head screws, two along each of the legs at intersection with strong back channels.

b. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 12 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the trusses at the top and bottom of the blocking at each Steel Framing Member (Item 3Nc) location with 16d nails or minimum 2-1/2 in. screws.

c. **Steel Framing Members*** — Used to attach furring channels (Item 3Na) to trusses. Clips spaced 48 in. OC and secured along truss webs at each furring channel intersection with min. 3/4 in. long self-drilling #10 x 1-1/2 in. screws through each of the provided hole locations. Furring channels are friction fitted into clips.

PAC INTERNATIONAL L L C — Type RSIC-S1-1 Ultra

3O. Resilient Channels — For Use With Item 4G and 7C. Formed from min 25 MSG galv steel installed perpendicular to trusses and spaced 16 in. OC. Channels secured to each truss with 1-1/4 in. long Type S bugle head steel screws. Channels overlapped 4 in. at

splices. Two channels, spaced 6 in. OC, oriented opposite each gypsum panel end joint. Additional channels shall extend min 6 in. beyond each side edge of panel. Insulation, Item 7C is applied over the resilient channel/gypsum panel ceiling membrane.

3P. Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 3) — 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., spaced 24 in. OC max perpendicular to trusses. Channels secured to trusses as described in Item 3Pb. 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. Additional clips required to hold furring channel that supports the wallboard butt joints, as described in Item 4.

B. Steel Framing Members* — Used to attach furring channels (Item 3Pa) to trusses (Item 2). Clips spaced 48 in. OC max with No. 8 x 2-1/2 in. course drywall screw through the center grommet. Furring channels are friction fitted into clips.

CLARKDIETRICH BUILDING SYSTEMS — Type ClarkDietrich Sound Clips

3Q. Steel Framing Members* — (Optional, Not Shown) — Used as an alternate method to attach resilient channels (items 3 and 3G) to joists (Item 2). For use with items 3K, 4F and 7G. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and spaced max 24 in. O.C. Channel ends butted and centered under the joists and attached to the joists with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints, as described in Item 3K. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the joists with the 2in. screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Types RC-1 Boost

3R. Steel Framing Members* — (Optional) — As an alternate to Item 3G — Used as an alternate method to attach furring channels to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to the bottom chord of alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item 3. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two min 7/16 in. long No. 6 self-tapping framing screws, at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. When Fiber, Sprayed (Item 6) is used, furring channel spacing reduced to 16 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board shall be installed as described in Item 4.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-1 (2.75), RSIC-SI-X.

3S. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 3G.

a. Furring Channels — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC, perpendicular to trusses. Channels secured to Cold Rolled Channels at every intersection with a 3/4 in. TEK screw through each furring channel leg. Ends of adjoining channels overlapped 12 in. and fastened together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap, or with two 3/4 in. TEK screws in each leg of the overlap section. Two furring channels used at end joints of gypsum board (Item 4), each extending a min of 6 in. beyond both side edges of the board.

b. Cold Rolled Channels — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to trusses, friction-fitted into the channel caddy on the Steel Framing Members (Item 3Md) and secured with two 3/4 in. TEK screws. Adjoining lengths of cold rolled channels lapped min. 12 in. and secured along bottom legs with four 3/4 in. TEK screws and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. Blocking — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 12 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the trusses at the top and bottom of the blocking at each Steel Framing Member (Item 3Md) location with 16d nails or minimum 2-1/2 in. screws.

d. Steel Framing Members* — Spaced 48 in. OC. max along truss, and secured to the truss on alternating trusses with two, #10 x 2in. screws through mounting holes on the hanger bracket.

PAC INTERNATIONAL L L C — Type RSIC-SI-CRC EZ Clip

3T. Steel Framing Members* — (Optional, Not Shown) — As an alternate to Item 3G.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, nominal 2-1/2 in. wide by 7/8 in. deep, spaced 24 in. OC perpendicular to trusses and friction fit into Steel Framing Members (Item 3Nc). Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap or with two TEK screws along each leg of the 6 in. overlap. Two furring channels used at end joints of gypsum board (Item 4). Butt joint channels held in place by strong back channels placed upside down, on top of, and running perpendicular to primary furring channels, extending 6 in. longer than length of gypsum side joint. Strong back channels spaced maximum 48 in. OC. Strong back channels secured to every intersection of primary furring channels with four 7/16 in. pan head screws, two along each of the legs at intersections. Butt joint channels run perpendicular to strong back channels and shall be minimum 6 in. longer than length of joint, secured to strong back channels with 7/16 in. pan head screws, two along each of the legs at intersection with strong back channels.

b. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 12 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the trusses at the top and bottom of the blocking at each Steel Framing Member (Item 3Nc) location with 16d nails or minimum 2-1/2 in. screws.

c. **Steel Framing Members*** — Used to attach furring channels (Item 3Na) to trusses. Clips spaced 48 in. OC and secured along truss webs at each furring channel intersection with min. 3/4 in. long self-drilling #10 x 2 in. screws through each of the provided hole locations. Furring channels are friction fitted into clips.

PAC INTERNATIONAL L L C — Type RSIC-S1-1 Ultra

3U. Steel Framing Members* — (Optional, Not Shown) — For Use with Item 7G- Used as an alternate method to attach furring channels to trusses. Clips spaced 48 in. OC. and secured to the bottom chord to alternating trusses with one No. 8 x 2-1/2 in. screw and washer through the center hole. Furring channels are friction fitted into clips. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap or screw attached with two pan head screws on each leg of overlap. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 4. Not evaluated for use with Item 6.

ISOTECH INDUSTRIES INC. — Type ISOWALL

4. Gypsum Board* — One layer of nom 5/8 in. thick, 4 ft wide gypsum board, installed with long dimension perpendicular to furring or resilient channels. Gypsum board secured with 1 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. End joints secured to both resilient channels as shown in the end joint detail. When **Steel Framing Members** (Item 3B and 3P) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimension perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long No. 6 Type S bugle head screws spaced 12 in. OC in the field of the board. Gypsum board butt joints shall be staggered 2 ft within the assembly, and shall occur between the main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels at each butt joint shall be spaced approximately 3-1/2 in. OC, and be attached to the bottom chord of the truss with one clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. When both **Steel Framing Members** (Item 3B) and **Fiber, Sprayed** (Items 6 or 6A) are used, furring channel spacing reduced to 16 in. OC and two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimension perpendicular to furring channels. Base layer secured to furring channels with nom 1 in. long No. 6 Type S bugle head screws spaced 12 in. OC in the field of the board. Gypsum board butt joints shall be staggered 2 ft within the assembly, and shall occur between the main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels at each butt joint shall be spaced approximately 3-1/2 in. OC, and be attached to the bottom chord of the truss with one RSIC-1 clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer secured to furring channels using 1-5/8 in. long No. 6 Type S screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min. of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min. 18 in. from butted side joints of base layer. When **Steel Framing Members** (Item 3C) are used, two layers of nom 5/8 in. thick, 4 ft wide are installed with long dimensions perpendicular to furring channels. Base layer attached to the furring channels using 1 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Butted end joints shall be staggered min 2 ft. within the assembly, and occur midway between the continuous furring channels. Each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The two furring channels shall be spaced approximately 4 in. OC, and be attached to underside of the truss with one Isomax clip at each end of the channel. Screw spacing along the gypsum board butt joint shall be 8 in. OC. Outer layer attached to the furring channels using 1-5/8 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field. The end of the outer layer boards at the butt joint shall be attached to the base layer boards with 1-5/8 in. long Type G screws spaced 8 in. OC and 1-1/2 in. from the end joint. Butted end joints to be offset a min of 8 in. from base layer end joints. Butted side joints of outer layer to be offset min 18 in. from butted side joints of base layer. When **Steel Framing Members** (Item 3D)

are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long No. 6 Type S bugle-head steel screws spaced 12 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 16 in. within the assembly. . At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. These additional furring channels shall be attached to underside of the truss with Genie clips as described in Item 3D. Screw spacing along the gypsum board butt joint shall be 6 in. OC. When **Steel Framing Members** (Item 3E) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Additional screws shall be placed in the adjacent section of gypsum board into the aforementioned 3 in. extension of the extra butt joint channels as well as into the main channel that runs between . Butt joint furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel. When **Fiber, Sprayed** (Items 6 or 6A) is used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels. Base layer gypsum board secured with 1 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. End joints secured to both resilient channels as shown in the end joint detail. Outer layer gypsum board secured with 1-5/8 in. long No. 6 Type S bugle head steel screws spaced 12 in. OC and located a min of 1-1/2 in. from side and end joints. Outer layer shall be finished as described in Item 5. When **Foamed Plastic** insulation (Item 7E) is applied to the underside of the subflooring, screw spacing shall be reduced to 8 in. OC with minimum 1-1/4 in. long Type S screws to install gypsum to the resilient channels (Item 3A). Resilient channels (Item 3A) to be spaced maximum 12 in. OC. Butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. End joints secured to both resilient channels as shown in end joint detail.

When **Steel Framing Members** (Item 3E) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, an additional single length of furring channel shall be installed and be spaced approximately 3 in. from the butt joint (6 in. from the continuous furring channels) to support the floating end of the gypsum board. Each of these shorter sections of furring channel shall extend one truss beyond the width of the gypsum panel and be attached to the adjacent trusses with one SonusClip at every truss involved with the butt joint.

When **Steel Framing Members*** (Item 3I) are used, one layer of 5/8 in. thick, 48 in. wide gypsum board, installed with long dimension perpendicular to cross channels with side joints centered along main runners. Gypsum board fastened to cross channels with 1 in. long No. 8 Type S bugle head steel screws located 1/2 in. from end joints and 1-3/4 in. from side joints and spaced 8 in. OC along the end joints and in the field. Panels fastened to cross tees with 1 in. long, Type S bugle-head screws spaced in the field and 8 in. OC along end joints. Panels fastened to main runners with 1 in. long, Type S bugle-head screws spaced midway between cross tees. Screws along sides and ends of panels spaced 3/8 to 1/2 in. from panel edge. Gypsum board sheets screw attached to leg of wall angle with 1 in. long No. 8 Type S bugle head steel screws spaced 12 in. OC. End joints of panels shall be staggered with spacing between joints on adjacent panels not less than 4 ft OC.

When **Steel Framing Members** (Item 3J) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to resilient channels. Gypsum board secured to resilient channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board and located 3/4 in. from side joints and 1-1/2 in. from end joints. Gypsum board joints are to be staggered by a minimum of 24 in.

When **Steel Framing Members** (Item 3M) are used, nom 5/8 in. thick, 4 ft wide gypsum board, installed as described in Item 4. Adjacent butt joints staggered minimum 48 in. OC.

When **Steel Framing Members** (Item 3N) are used, nom 5/8 in. thick, 4 ft wide gypsum board, installed as described in Item 4. Butt joints staggered minimum 24 in. OC.

When **Steel Framing Members** (Item 3U) are used, nom 5/8 in. thick, 4 ft wide gypsum board, installed as described in Item 4. Butt joints staggered minimum 48 in. OC.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Type C

CGC INC — Types C, IP-X2, IPC-AR

CERTAINTED GYPSUM INC — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types eXP-C, FSK-C, FSW-C, FSW-G

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

4A. **Gypsum Board** — For use when Item 3C is used and **Batts and Blankets*** are secured to the plywood subfloor, to the trusses or draped over the furring channel/gypsum panel ceiling membrane as described in Item 3C. For method of gypsum board installation, see Item 4.

CGC INC — Types C, IP-X2, IPC-AR

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

4B. **Gypsum Board*** — For use when **Batts and Blankets*** (Item 7A) and Resilient Channels (Item 3F) are used. Nom 5/8 in. thick, 4 ft wide gypsum board installed with long dimension perpendicular to resilient channels. Nom 1 in. long No. Type S bugle head screws are driven through channel spaced 8 in. OC. End joints of gypsum board similarly fastened to additional resilient channels positioned at end joint locations.

AMERICAN GYPSUM CO — Type AG-C.

CERTAINTED GYPSUM INC — Type LGFC-C/A

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

4C. **Gypsum Board*** — For use with Items 3G and 7C or 3I and 7F, or 3I and 7C. Nom 5/8 in. thick, 48 in. wide gypsum panels installed with long dimension perpendicular to resilient channels. Gypsum panels secured with 1 in. long Type S bugle head steel screws spaced 8 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. Finish Rating with this ceiling system is 20 min.

CGC INC — Type ULIX

UNITED STATES GYPSUM CO — Type ULIX

4D. **Gypsum Board*** — For use when Flooring System (Item 1) consists of both System No. 1 and min 15/32 in. plywood, min grade "Underlayment" or "Sturd-I-Floor" with T & G edges and conforming with PS1-83 specifications, or min 3/4 in. thickness of any Floor Topping Mixture (CCOX) bearing the UL Classification Marking as to Fire Resistance, min Truss depth (Item 2) is 18 in. and Batts and Blankets (Item 7D) and Resilient Channels (Item 3A) are used. One layer of nom 5/8 in. thick, 48 in. wide gypsum board installed with

long dimension perpendicular to resilient channels. Gypsum board secured with 1 in. long Type S bugle head steel screws. Screws spaced 1 in. from side joints, and 12 in. OC in the rest of the field. Screws spaced 1-1/2 in. from the end joints. End joints secured to both resilient channels as shown in end joint detail. When batt insulation (Item 7D) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel (Item 3A) spacing shall be reduced to 12 in. OC., and gypsum board screws spaced 1 in. from side joints, and 8 in. OC in the rest of the field. For use only with Ceiling Damper described in Item 9R.

PANEL REY S A — Type PRC2

4F. Gypsum Board* — For use with Items 3K, 3L, and 7G— One layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to resilient channels. Gypsum board secured to resilient channels with min nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board and located 3/4 in. from side joints and 1-1/2 in. from end joints. Gypsum board butt joints are to be staggered by a minimum of 24 in.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C

4G. Gypsum Board* — For use with Items 3G and 7C. Nom 5/8 in. thick, 48 in. wide gypsum panels installed with long dimension perpendicular to resilient channels. Gypsum panels secured with 1 in. long Type S bugle head steel screws spaced 8 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints.

AMERICAN GYPSUM CO — Type AG-C.

5. Finishing System — (Not Shown) — Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

6. Fiber, Sprayed* — (Dry Dense Packed 100% Borate Formulation) — (Not Shown, Optional) — The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 6 (Fiber, Sprayed, Dry Dense Packed) is used, Furring Channels (Item 3F) or Resilient Channels (Item 3A) spacing shall be reduced to 12 in. OC. When Item 6 (Fiber, Sprayed, Dry Dense Packed) is used, two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 3C.

APPLEGATE GREENFIBER ACQUISITION LLC — Insulmax and SANCTUARY to be used with dry application only.

6A. Fiber, Sprayed* — (Loose Fill 100% Borate Formulation) — (Not Shown, Optional) — The finished rating when Fiber, Sprayed is used has not been determined. The fiber is applied without water or adhesive at a minimum dry density of 0.5 lb/ft³ and at a max thickness of 3-1/2 in., in accordance with the application instructions supplied with the product. When Item 6A (Fiber, Sprayed, Loose Fill) is used, Furring Channels (Item 3F) or Resilient Channels (Item 3A) spacing shall be reduced to 12 in. OC. When Item 6A (Fiber Sprayed, Loose Fill) is used, two layers of gypsum board required as described in Item 4. Not evaluated for use with Item 3C.

APPLEGATE GREENFIBER ACQUISITION LLC — Insulmax & SANCTUARY to be used with dry application only.

7. Batts and Blankets* — (Not Shown) — For use with Item 3D — Nom 3 in. thick mineral wool insulation held suspended in the concealed space with 0.090 in. diam galv steel wires attached to the wood trusses at 18 in. OC.

7A. Batts and Blankets* — For Use With Items 3F and 4B — Glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance having a min. density of 0.5 pcf, draped over the resilient channel/gypsum panel ceiling membrane. No limit on overall thickness.

7B. Batts and Blankets* — (Not Shown) — For use with Item 3E — Nom 3-1/2 in. thick, min. 2 pcf fiber glass insulation held suspended in the concealed space with nominal 0.090 in. diam galv steel wires attached to the wood trusses at nominally 16 in. OC.

7C. Batts and Blankets* or Fiber, Sprayed* — For Use with Item 4C (Not Shown) — Min. 3-1/2 in thick with no limit on maximum thickness fitted in the concealed space, draped over the resilient channel (Item 3G)/gypsum board (Item 4C or 4G) ceiling membrane.

7D. Batts and Blankets* — For Use With Item 4D — Insulation may be secured to plywood subfloor with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC. Insulation may alternatively be draped over the resilient channels and gypsum board ceiling membrane, and the resilient channels and gypsum board attachment shall be modified as specified in Item 4D. Any glass fiber insulation bearing the UL Classification Marking for Surface Burning Characteristics and/or Fire Resistance, and having a min density of 0.5 pcf and max thickness of 3-1/2 in. may be used.

7E. Foamed Plastic* — (As alternate to Item 6 and 6A, Not Shown) — Spray foam insulation applied directly to the underside of the plywood subflooring. Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ or 2.0 lb/ft³ density, depending on the product installed. Spray foam insulation is limited to use with minimum 18 in. deep trusses (Item 2). When spray foam insulation is installed, resilient channels (Item 3A) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 4) spaced maximum 3 in. away from gypsum butt joints. Gypsum board (Item 4) to be installed using minimum 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a ceiling damper (Item 9) in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. Not evaluated for use with Items 3, 3B through 3F, 3G, 6, 6A, 7 through 7D. Not evaluated with Flooring System (Item 1) Configuration No. 1.

BASF CORP — Evertite® NM, Evertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US, Walltite® US-N, Walltite® HP+, Walltite® MAX, Walltite® v.5, Walltite® LWP, Walltite® Plus and Evertite® Max.

7F. Batts and Blankets* — (Not Shown) For Use with Item 3I and 4C — Glass fiber or mineral wool insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. There is no limit in the overall thickness of insulation, and the insulation can be secured against the subflooring, held suspended in the concealed space or draped over the Steel Framing Members and gypsum panel membrane.

7G. Batts and Blankets* — (Not Shown) For Use with Item 3L, 3K, 3U, and 4F — Glass fiber or mineral wool insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. There is no limit in the overall thickness of insulation, and the insulation can be secured against the subflooring, held suspended in the concealed space or draped over the Steel Framing Members and gypsum panel membrane.

7H. Foamed Plastic* — (As alternate to Items 6 and 7) — Spray foam insulation applied directly to the underside of the plywood subflooring. Spray foam insulation installed to a maximum thickness of 11 in. at a nominal 1.0 lb/ft³ - 2.5 lb/ft³ density, while maintaining a minimum 7 in. clearance between the spray foam insulation and the gypsum board (Item 4). Spray foam insulation is limited for use with minimum 18 in. deep trusses (Item 2). When spray foam insulation is installed, resilient channels (Item 3A) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board spaced maximum 3 in. away from gypsum butt joints. Gypsum board to be installed using minimum 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a ceiling damper (Item 9) in the concealed space, no clearance is necessary between damper housing and spray foam insulation. Only for use with item 3A not evaluated for use with alternates to item 3A.

CARLISLE SPRAY FOAM INSULATION — Types SealTite Pro Closed Cell (CC), SealTite Pro Open Cell (OC), SealTite Pro OCX, SealTite Pro No Trim 21, SealTite Pro One Zero, SealTite PRO HFO, Foamsulate Closed Cell, Foamsulate OCX, Foamsulate 70, Foamsulate HFO, and Foamsulate HFO 2.0.

7I. Batts and Blankets* — (Not Shown - Required as indicated with Flooring System No. 26) - Glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. Min. 3-1/2 in. thick, 0.92 pcf density, draped over the resilient or furring channels and gypsum panel membrane. Resilient or furring channels to be spaced 12 in. OC with extra channels installed at butt joints as indicated above.

8. Air Duct* — (Optional) — Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.

9. Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max. nom area shall be 349 sq in. Max. overall length and width shall not exceed 18-11/16 in. by 18-11/16 in. with max. 16 in. by 16 in. register opening. Aggregate damper openings shall not exceed 175 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. An aluminum or steel grille (Item 10) shall be installed in accordance with installation instructions.

MIAMI TECH INC — Model Series RxCRD, RxCRDS or RxCRPD

9A. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max damper assembly size nom 18 in. long by 18 in. wide and 4-1/4 in. high, or 8 in. diam. fabricated from galv steel. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

RUSKIN COMPANY — Model CFD7T, CFD7T-END-BT, CFD7T-90-BT, CFD7T-ST-BT, CFD7T-SB, CFD7T-R6-DB, CFD-7T-IB6 or CFDR7T

9B. Deleted.

9C. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 12 in. diameter damper with insulated register box assembly. The maximum size of the register box assembly is nom. 20 in. long by 20 in. wide and 4 in. high fabricated from galv steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 57

9D. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 20 in. long by 16 in. wide by 4 in. high rectangular damper with duct board plenum box assembly. The maximum outer dimensions of the plenum box assembly are 23-1/2 in. long by 19-1/2 in. wide and 17 in. high fabricated from 6pcf, 1-1/2 to 2 in. thick Knauf Air Duct Board M*. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 160 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 58

9E. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 14 in. long by 14 in. wide by rectangular damper with 90° boot. The maximum size of damper/boot assembly is 14 in. long by 14 in. wide and 18 in. high fabricated from galv steel. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 98 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Models 50 w/ Boot, 50EA w/ Boot, 51 w/Boot, 50 w/ Box, 50EA w/ Box or 51 w/Box

9F. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min 18 in. deep trusses Not for use with flooring system 1 or 17. Max plenum box size nom 19 in. long by 19 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

LLOYD INDUSTRIES INC — Model CRD 50-BT, CRD 50-EA-BT, CRD 55-BT, CRD 55 EA-BT

UNITED ENERTECH CORP — Model C-S/R-WT-L, C-S/R-EA-L, C-S/R-BT, C-S/R-EA-BL

9G. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8). For use with min 18 in. deep trusses Not for use with flooring system 1 or 17. Max plenum box size nom 13 in. long by 13 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 50 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

LLOYD INDUSTRIES INC — Model CRD 50-BT-6, CRD 50-EA-BT-6, CRD 55-BT-6, CRD 55 EA-BT-6

9H. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 103 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 10-1/8 in. Aggregate damper openings shall not exceed 52 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

PANASONIC CORPORATION, PANASONIC CORPORATION OF NORTH AMERICA — Model PC-RD05C5

9I. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 113 sq in. with the length not to exceed 10-1/8 in. and the width not to exceed 11-1/8 in. Aggregate damper openings shall not exceed 57 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDFUWT

9J. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 79 sq in. with the length not to exceed 10 in. and the width not to exceed 7-15/16 in. Aggregate damper openings shall not exceed 40 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A metallic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Models RDJ1 and RDH

9K. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8). For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max plenum box size nom 19 in. long by 19 in. wide and 11-7/8 in. high fabricated from galv steel. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper.

METAL-FAB INC — Models MSCD-HC and MRCD-HC

9L. Alternate Ceiling Damper* — (Optional, To be used with Air Duct Item 8). Ceiling damper & fan assembly for use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 87 sq in. with the length not to exceed 9 in. and the width not to exceed 9-11/16 in. Aggregate damper openings shall not exceed 44 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDMWT

9M. Alternate Ceiling Damper* — Ceiling damper & fan assembly for use with min 18 in. deep trusses. Max nom area shall be 87 sq in. with the length not to exceed 9 in. and the width not to exceed 9-11/16 in. Aggregate damper openings shall not exceed 44 sq in. per 100 sq ft of ceiling area. Damper shall be installed in combination with one of the fan models described in, and in accordance with, the manufacturer's installation instructions provided with the damper. A plastic grille (Item 10) shall be installed in accordance with installation instructions.

BROAN-NUTONE L L C — Model RDMWT2

9N. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8) — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom 21 in. long by 18 in. wide, fabricated from galvanized steel. Plenum box max size nom 21 in. long by 18 in. wide by 14 in. high (inner dimension) fabricated from either galvanized steel or min 1 in. thick Listed Duct Board bearing the UL Listing Marking having a min R-Value of 4.3. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 180 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-1WT

9O. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8) — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom 12 in. long by 12 in. wide with an 8 in. diameter damper, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 72 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-2WT

9P. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 324 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 14 in. Aggregate damper openings shall not exceed 162 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521

POTTORFF — Model CFD-521

9Q. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 196 sq in. with the length not to exceed 26 in. and the width not to exceed 14 in. Max height of damper shall be 7 in. Aggregate damper openings shall not exceed 98 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) not to exceed 144 in.² shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Model RD-521-BT

POTTORFF — Model CFD-521-BT

9R. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 256 sq in. with the length not to exceed 24 in. and the width not to exceed 20 in. Max height of damper shall be 17 in. Aggregate damper openings shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Models RD-521-IP, RD-521-NP

POTTORFF — Models CFD-521-IP, CFD-521-NP

9S. Alternate Ceiling Damper* — For use with min 18 in. deep trusses. Not for use with flooring system 1 or 17. Max nom area shall be 144 sq in. with the length not to exceed 14 in. and the width not to exceed 12 in. Max height of damper shall be 17-7/8 in. Aggregate damper openings shall not exceed 74 sq in. per 100 sq ft of ceiling area. Damper installed in accordance with the manufacturers installation instructions provided with the damper. A steel grille (Item 10) shall be installed in accordance with installation instructions.

C&S AIR PRODUCTS — Models RD-521-90, RD-521-NP90

POTTORFF — Models CFD-521-90, CFD-521-90NP

9T. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min 18 in. deep trusses. For use with Item 4D only. Not for use with flooring system 1. Maximum 20 in. long by 18 in. wide by 2-1/8 in. high, fabricated from galvanized steel. Plenum box maximum size nom. 21 in. long by 18 in. wide by 16 in. high fabricated from either galvanized steel or Classified Air Duct Materials bearing the UL Class 0 or Class 1 rigid air duct material. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 180 sq in. per 100 sq ft of ceiling area.

NAILOR INDUSTRIES INC — Types 0755, 0755A, 0756, 0756D, 0757, 0757D, 0757FP, 0757DFP, 0763

SAFE AIR DOWCO — 0455, 0455A, 0456, 0456D, 0457, 0457D, 0457-DB, 0457-CB, 0463-FB, 0457-EB, 0463-GB, 0463

9U. Alternate Ceiling Damper* — (Optional, to be used with Air Duct Item 8) For use with min 18 in. deep trusses. Max nom 11-1/8 in. long by 13-5/8 in. wide, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 76 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-310WT

9V. Alternate Ceiling Damper* — (Optional, to be used with Air Duct Item 8) For use with min 18 in. deep trusses. Max nom 12-3/8 in. long by 14-1/2 in. wide, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 90 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-320WT

9W. Alternate Ceiling Damper* — (Optional, to be used with Air Duct Item 8) For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 12 in. diameter damper within max 15 in. by 15 in. register box with max 12 in. by 12 in. register opening fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 72 sq. in. per 100 sq. ft. of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

RUSKIN COMPANY — Model CFD7T-SR

9X Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 12 in. diameter damper and insulated register box assembly. The maximum size of the register box assembly is nom. 20 in. long by 20 in. wide and 4 in. high fabricated from galv steel. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

SOUTHWARK METAL MFG CO — Model 800 w/Box

9Y Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 20 in. long by 16 in. wide by 4 in. high rectangular damper with plenum box assembly. The maximum outer dimensions of the plenum box assembly are 23-1/2 in. long by 19-1/2 in. wide and 17 in. high fabricated from 6pcf, 1-1/2 to 2 in. thick Knauf Air Duct Board M*. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 160 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

SOUTHWARK METAL MFG CO — CRD w/DB Box

9Z Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 14 in. long by 14 in. wide and 18 in. high ceiling damper with boot or box assembly, fabricated from galv steel. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 98 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

SOUTHWARK METAL MFG CO — Model 500 w/Boot, 510 w/Boot, 500 w/Box or 510 w/Box

9AA. Alternate Ceiling Damper* — (Optional, to be used with Air Duct Item 8) For use with min 18 in. deep trusses. Max nom 10-3/8 in. long by 10-3/8 in. wide, fabricated from galvanized steel. Installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 54 sq in. per 100 sq ft of ceiling area.

GREENHECK FAN CORP — Model CRD-300WT

9AB. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 7-11/32 in. long by 7-11/16 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 28.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models ITG-CRD2.

9AC. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 9-11/16 in long by 9-1/16 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 44.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models SIG-CRD2

9AD. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 10-13/32 in. long by 10-22/32 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 56 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models SMT-CRD2

9AE. Alternate Ceiling Damper* — (Optional. To be used with Air Duct Item 8.) — For use with min. 18 in. deep trusses. Not for use with flooring system 1 or 17. Max 8-13/16 in. wide and 8-1/2 in. long fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 37.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models GBR-CRD2

10. Grille — Aluminum or Steel grille, installed in accordance with the installation instructions provided with the ceiling damper.

11. Discrete Products Installed in Air-handling Spaces* — Automatic Balancing Valve/Damper — (Not Shown - Optional) — For use with item 9A, Ruskin Company's Model CFD7T damper (CABS). Ceiling damper to be provided with plenum box per damper manufacturer's instructions with side outlet only. Entire assembly to be installed into any UL Class 0 or Class 1 flexible air duct in accordance with the instructions provided by the automatic balancing valve/damper manufacturer.

NAILOR INDUSTRIES INC — Model ABV-4, ABV-5, ABV-6

*** 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 2024-09-02

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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. P556

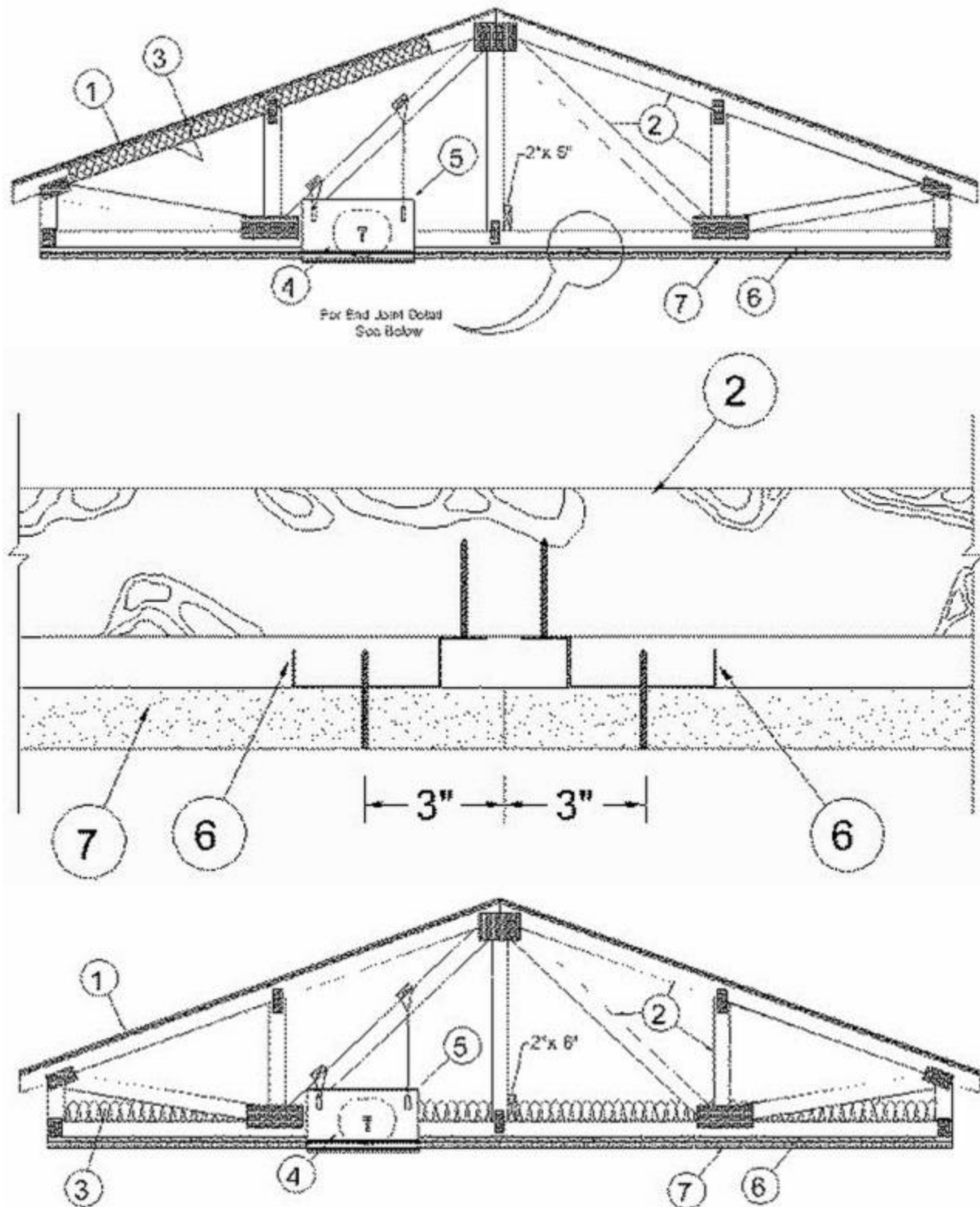
June 14, 2024

Unrestrained Assembly Rating — 1 Hr.

Finish Rating — 24 or 25 Min (See Items 3, 3A and 3B)

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. **Roofing System*** — Any UL Class A, B or C Roofing System (**TGFU**) or Prepared Roof Covering (**TFWZ**) acceptable for use over nom 15/32 in. thick wood structural panels, min. grade "C-D" or "Sheathing". Nom 15/32 in. thick wood structural panels secured to trusses with No. 6d ringed shank nails. Nails spaced 12 in. OC along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Construction adhesive is optional and may be used with either nails or staples.

2. **Trusses** — Pitch or Parallel chord trusses, spaced a max of 24 in. OC, fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Truss members secured together min. 0.0356 in. thick galv steel plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The

top half of each tooth has a twist for stiffness. The pairs are repeated on approximately 7/8 in. centers with four rows of teeth per inch of plate width. Minimum parallel chord truss depth shall be 18 in. Where the truss intersects with the interior face of the exterior walls, the min truss depth shall be 5-1/4 in. with a min roof slope of 3/12 and a min. average depth of 18 in.. Where the truss intersects with the interior face of the exterior walls, the min truss depth may be reduced to 3 in. if the batts and blankets (Item 3) are used as shown in the above illustration (Alternate Insulation Placement) and are firmly packed against the intersection of the bottom chords and the plywood sheathing.

3. Batts and Blankets* — (Optional) -Glass fiber insulation, secured to the wood structural panels with staples spaced 12 in. OC or to the trusses with 0.090 in. diam galv steel wires spaced 12 in. OC. Any glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance, having a min density of 0.5 pcf. As an option, the insulation may be fitted in the concealed space, draped over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. The Finish Rating is 24 min. when the insulation is draped over the resilient channels and gypsum board ceiling membrane and 25 min. when it is installed on underside of the plywood deck or when it is omitted.

3A. Loose Fill Material* — As an alternate to Item 3 — Any thickness of loose fill material bearing the UL Classification Marking for Surface Burning Characteristics, having a min density of 0.5 pcf, fitted in the concealed space, draped over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. The finished rating when loose fill material is used has not been determined.

3B. Fiber, Sprayed* — As an alternate to Items 3 and 3A (not evaluated for use with Items 6B, 6C, 6D and 6E) — Any thickness of spray-applied cellulose insulation material, having a min density of 0.5 lb/ft³, applied with water, over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. Fiber, Sprayed is applied with moisture in accordance with the application instructions supplied with the product. The finish rating when Fiber Sprayed is used has not been determined. Alternate application method: The fiber is applied without water or adhesive in accordance with the application instructions supplied with a minimum density of 0.5 lb/ft³ over the resilient channel/gypsum board ceiling membrane when resilient channels and gypsum board attachment is modified as specified in Items 6 and 7. Alternate application method: The fiber is applied without water or adhesive to a nominal density of 3.5 lb/ft³ behind netting (Item 9) stapled to the rafters. The netting is stapled at both lower edges of the rafters creating a cavity to accept the cellulose fiber.

APPLEGATE GREENFIBER ACQUISITION LLC — Insulmax and SANCTUARY for use with wet or dry application.

3C. Foamed Plastic* — (As an alternate to Item 3 - Not Shown) — Spray foam insulation applied directly to the underside of the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ density, while maintaining a minimum 8-1/2 in. clearance between the spray foam insulation and the gypsum board (Item 7). When spray foam insulation is used, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) installed at 6 in. OC to allow for maximum 3 in. spacing off ends of the gypsum board joints. Gypsum board (Item 7) to be installed using 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a ceiling radiation damper in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. . Limited to resilient channels, Item 6 only, no Item 6 alternates. The finished rating when this insulation is used has not been determined.

Holcim Solutions and Products US, LLC — Sucraseal

3D. Foamed Plastic* — (As alternate to Item 3 - Not Shown) — Spray foam insulation applied directly to the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 10 in. at a nominal 0.5 lb/ft³ or 2.0 lb/ft³ density, depending on the product installed. When spray foam insulation is installed, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) spaced maximum 3 in. away from gypsum butt joints. Gypsum board (Item 7) to be installed using minimum 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a ceiling radiation damper in the concealed space, minimum 1 in. clearance to be maintained between damper housing and spray foam insulation. Limited to resilient channels, Item 6 only, no Item 6 alternates. The finished rating when this insulation is used has not been determined.

BASF CORP — Enertite® NM, Enertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US, Walltite® US-N, Walltite® HP+, Walltite® MAX, Walltite® v.5, Walltite® LWP, Walltite® Plus and Enertite® Max

3E. Foamed Plastic* — (As an alternate to Item 3 - Not Shown) — Spray foam insulation applied directly to the underside of the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 17 in. at a nominal 0.5 lb/ft³ density, while maintaining a minimum 1-1/2 in. clearance between the spray foam insulation and the gypsum board (Item 7). When spray foam insulation is used, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) installed at 6 in. OC to allow for maximum 3 in. spacing off ends of the gypsum board joints. Gypsum board (Item 7) to be installed using 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a fire damper (Items 5 through 5B) in the concealed space, no clearance is necessary between damper housing and spray foam insulation. . Limited to resilient channels, Item 6 only, no Item 6 alternates. The finished rating when this insulation is used has not been determined.

Holcim Solutions and Products US, LLC — EasySeal.5, EasySeal ULD

3F. Foamed Plastic* — (As an alternate to Item 3 - Not Shown) — Spray foam insulation applied directly to the underside of the underside of the roofing system (Item 1). Spray foam insulation installed to a maximum thickness of 17 in. at a nominal 0.5 lb/ft³ density, while maintaining a minimum 1-1/2 in. clearance between the spray foam insulation and the gypsum board (Item 7). When spray foam insulation is used, resilient channels (Item 6) shall be installed maximum 12 in. OC, with channels adjacent to butt joints of gypsum board (Item 7) installed at 6 in. OC to allow for maximum 3 in. spacing off ends of the gypsum board joints. Gypsum board (Item 7) to be installed using 1-1/4 in. long Type S screws, spaced maximum 8 in. OC, and butted end joints shall be staggered min. 2 ft within the assembly, and occur midway between the continuous furring channels. If used with a fire damper (Items 5 through 5B) in the concealed space, no clearance is necessary between damper housing and spray foam insulation. . Limited to resilient channels, Item 6 only, no Item 6 alternates. The finished rating when this insulation is used has not been determined.

EVEREST SYSTEMS LLC — Opticell 0.5

4. Air Duct* — For use with **Ceiling Dampers*** - Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.

5. Ceiling Damper* — Max 14 in. long by 14 in. wide by 18 in. high ceiling damper with boot or box assembly, fabricated from galv steel. The aggregate area of the register opening(s) through the ceiling membrane shall not exceed 98 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Model 50 w/Boot, 50EA w/Boot, 51 w/Boot, 50 w/Box, 50EA w/Box or 51 w/Box.

AIRVAC INDUSTRIES — Series AVI-50 w/Boot, AVI-50EA w/Boot, AVI-51 w/Boot, AVI-50 w/Box, AVI-50EA w/Box, AVI-51 w/Box.

5A. Alternate Ceiling Damper* — Max 12 in. diameter damper and insulated register box assembly. The maximum size of the register box assembly is nom. 20 in. long by 20 in. wide and 4 in. high fabricated from galv. Steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 128 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 57

AIRVAC INDUSTRIES — Model AVI-57IB

5B. Alternate Ceiling Damper* — Max 20 in. long by 16 in. wide by 4 in. high rectangular damper with duct board plenum box assembly. The maximum outer dimensions of the plenum box assembly is 23-1/2 in. long by 19-1/2 in. wide and 17 in. high fabricated from 6pcf, 1-1/2 to 2 in. thick Knauf Air Duct Board M*. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 160 sq in. per 100 sq ft ceiling area. Damper assembly installed in accordance with the manufacturers installation instructions.

AIRE TECHNOLOGIES INC — Series 58

AIRVAC INDUSTRIES — Series AVI-58

5C. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 4.) — For use with min. 18 in. deep trusses. Max 7-11/32 in. long by 7-11/16 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 28.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models ITG-CRD2.

5D. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 4.) — For use with min. 18 in. deep trusses. Max 9-11/16 in. long by 9-1/16 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 44.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models SIG-CRD2

5E. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 4.) — For use with min. 18 in. deep trusses. Max 10-13/32 in. long by 10-22/32 in. wide fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 56 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models SMT-CRD2

5F. **Alternate Ceiling Damper*** — (Optional. To be used with Air Duct Item 4.) — For use with min. 18 in. deep trusses. Max 8-13/16 in. wide and 8-1/2 in. long fabricated from galvanized steel. Aggregate area of the register opening(s) through the ceiling membrane shall not exceed 37.5 sq in. per 100 sq ft of ceiling area. Damper assembly installed in accordance with the manufacturer's installation instructions.

AIRE TECHNOLOGIES INC — Models GBR-CRD2

6. **Furring Channels** — Resilient channels formed of 25 MSG galv steel, spaced 16 in. OC, installed perpendicular to trusses. When batt and blanket material, Item 3, is draped over the resilient channel/gypsum board ceiling membrane, the spacing shall be 12 in. OC. Channels secured to each truss with 1-1/4 in. long Type S steel screws. Channels overlapped 4 in. at splices. Channels oriented opposite at board butt joints (spaced 6 in. OC) as shown in the above illustration.

6A. **Steel Framing Members* - (Not Shown)** — As an alternate to Item 6, 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 16 in. OC perpendicular to trusses. When batt insulation (Item 3) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to alternating trusses with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75).

6B. **Steel Framing Members*** — (Not Shown) - As an alternate to Items 6 and 6A.

a. **Furring Channels** — Hat-shaped furring channels, 7/8 in. deep by 2-5/8 in. wide at the base and 1-1/4 in. wide at the face, formed from No. 25 ga. galv steel, spaced max 16 in. OC perpendicular to trusses and Cold Rolled Channels (Item 6Bb). Furring channels secured to Cold Rolled Channels at every intersection with a 1/2 in. pan head self-drilling screw through each furring channel leg. Ends of adjoining channels overlapped 4 in. and tied together with two double strand No. 18 SWG galv steel wire ties, one at each end of overlap. Supplemental furring channels at base layer and outer layer gypsum board butt joints are not required. Batts and Blankets draped over furring channels as described in Item 3. Two layers of gypsum board attached to furring channels as described in Item 7.

b. **Cold Rolled Channels** — 1-1/2 in. by 1/2 in., formed from No. 16 ga. galv steel, positioned vertically and parallel to trusses, friction-fitted into the channel caddy on the Steel Framing Members (Item 6Bd). Adjoining lengths of cold rolled channels lapped min. 6 in. and wire-tied together with two double strand 18 SWG galv steel wire ties, one at each end of overlap.

c. **Blocking** — Where truss design does not permit direct, full contact of the hanger bracket, a piece of nominal 2 by 4 in. lumber (blocking), min. 6 in. long to permit full contact of the hanger bracket, to be secured vertically to the side of the truss (Item 2) at the top and bottom of the blocking at each Steel Framing Member (Item 6Bd) location.

d. **Steel Framing Members*** — Hangers spaced 48 in. OC. max along truss, and secured to the Blocking (Item 6Bc) on alternating trusses with a single 5/16 in. by 2 in. hex head lag bolt or four #6 1-1/4 in. drywall screws through mounting hole(s) on the hanger bracket. The two 1/4 in. long steel teeth on the hanger are embedded in the side of the blocking. Hanger positioned on blocking and leveling bolt height adjusted such that furring channels are flush with bottom of trusses before gypsum board installation. Spring gauge of hanger chosen per manufacturer's instructions.

KINETICS NOISE CONTROL INC — Type ICW.

6C. **Steel Framing Members*** — (Not Shown) - As an alternate to Items 6, 6A and 6B.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep installed perpendicular to wood structural members. Channels spaced a max of 16 in. OC when no insulation (Item 3, 3A or 3B) is fitted in the concealed space or a max of 12 in. OC when insulation (Item 3, 3A or 3B) is fitted in the concealed space. Channels secured to trusses as described in Item 6Cb. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 AWG galvanized steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ca) to trusses (Item 2). Clips secured to the bottom chord of each truss (24 in. OC) with one No. 8 by 2-1/2 in. long coarse drywall screw through center grommet. Furring channels are friction fitted into clips. Adjoining channels are overlapped as described in Item 6Ca. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel. Additional clips required to hold furring channel that supports the gypsum board butt joints, as described in Item 7.

PLITEQ INC — Type Genie Clip

6D. **Steel Framing Members*** — (Not Shown) - As an alternate to Items 6, 6A, 6B and 6C.

a. **Main runners** — Installed perpendicular to trusses — Nom 10 or 12 ft long, 15/16 in. or 1-1/2 in. wide face, spaced 4 ft OC. Main runners hung a min of 2 in. from bottom chord of trusses with 12 SWG galv steel wire. Wires located a max of 48 in. OC.

b. **Cross tees or channels** — Nom 4 ft long, 15/16 in. or 1-1/2 in. wide face or cross channels, nom 4 ft long, 1-1/2 wide face, installed perpendicular to the main runners, spaced 16 in. OC. Additional cross tees or channels used at 8 in. from each side of butted gypsum board end joints. The cross tees or channels may be riveted or screw-attached to the wall angle or channel to facilitate the ceiling installation.

c. **Wall angles or channels** — Used to support steel framing member ends and for screw-attachment of the gypsum board — Min 0.016 in. thick painted or galvanized steel angle with 1 in. legs or min. 0.016 in. thick painted or galvanized steel channel with a 1 by 1-1/2 by 1 in. profile, attached to walls at perimeter of ceiling with fasteners 16 in. OC.

CGC INC — Type DGL or RX.

USG INTERIORS LLC — Type DGL or RX.

6E. **Alternate Steel Framing Members*** — (Not Shown) - As an alternate to items 6, 6A, 6B, 6C and 6D, furring channels and Steel Framing Members as described below.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-5/8 in. wide by 7/8 in deep, spaced 16 in OC, perpendicular to trusses. When batt insulation (Item 3, 3A or 3B) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the wood trusses (Item 2). Clips spaced at 48" OC and secured to the bottom of the trusses with one 2 in. Coarse Drywall Screw with 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire. Additional clips are required to hold the Gypsum Butt joints as described in Item 7.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Type A237 or A237R

6F. **Steel Framing Members*** — (Not Shown) - As an alternate to Items 6 through 6E- Not for use with Items 3, 3A, or 3B. Main runners nom 12 ft long, spaced 72 in. OC. Main runners suspended by min 12 SWG galv steel hanger wires spaced 48 in. OC. Cross tees, nom 6 ft long, installed perpendicular to main runners and spaced 24 in. OC. Additional 6 ft long cross tees required at each gypsum board end joint with butted gypsum board end joints centered between cross tees spaced 8 in. OC. The main runners and cross tees may be riveted or screw attached to the wall angle or channel to facilitate the ceiling installation.

USG INTERIORS LLC — Type DGL or RX

6G. **Alternate Steel Framing Members*** — (Not Shown) - As an alternate to items 6 through 6F furring channels and Steel Framing Members as described below.

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-1/2 in. wide by 7/8 in deep, spaced 16 in OC, perpendicular to trusses. When batt insulation (Item 3, 3A or 3B) is draped over the resilient channel/gypsum board ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the wood trusses (Item 2). Clips spaced at 48" OC and secured to the bottom of the trusses with one 2-1/2 in. Coarse Drywall Screw with 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire. Additional clips are required to hold the Gypsum Butt joints as described in Item 7.

REGUPOL AMERICA — Type SonusClip

6H. **Furring Channels** — **For use with American Gypsum Co. Type AG-C gypsum board only.** Resilient channels formed of 25 MSG galv steel, spaced 16 in. OC, installed perpendicular to trusses. When insulation material, Item 3, 3A or 3B, is applied over the resilient channel/gypsum board ceiling membrane, the spacing may remain at 16 in. OC. Channels secured to each truss with 1-1/4 in. long Type S steel screws. Channels overlapped 4 in. at splices. Channels oriented opposite at gypsum board butt joints (spaced 6 in. OC) as shown in the above illustration.

7. **Gypsum Board*** — One layer of nom 5/8 in. thick, 48 in. wide, installed with long dimension perpendicular to resilient channels with 1 in. long Type S screws spaced 12 in. OC and located a min of 1/2 in. from side joints and 3 in. from the end joints. At end joints, two resilient channels are used, extending a min of 6 in. beyond both ends of the joint. When insulation (Item 3, 3A, 3B) is draped over the resilient channel/gypsum board ceiling membrane, screws shall be installed at 8 in. OC.

When **Steel Framing Members*** (Item 6A or 6C) are used, sheets installed with long dimension perpendicular to furring channels and side joints of sheet located beneath trusses. Gypsum board screws are driven through channel spaced 12 in. OC in the field when no insulation (Item 3, 3A, 3B) is fitted in the concealed space, or 8 in. OC in the field when insulation (Item 3, 3A, 3B) is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane. Gypsum board butt joints shall be staggered min. 2 ft within the assembly, and occur between the main furring channels. At the gypsum board butt joints, each end of the gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 6 in. on each end. The furring channels shall be spaced approximately 3-1/2 in. OC, and be attached to the trusses with one clip at each end of the channel. Screw spacing along the butt joint to attach the gypsum board to the furring channels shall be 8 in. OC. Second (outer) layer of gypsum board required when furring channels (Item 6A, a) are spaced 24 in. OC and insulation is fitted in the concealed space, draped over the furring channel/gypsum board ceiling membrane. Outer layer of gypsum board attached to the furring channels using 1-5/8 in. long Type S bugle-head screws spaced 8 in. OC at butted joints and 12 in. OC in the field. Butted end joints of outer layer to be offset a minimum of 8 in. from base layer end joints. Butted side joints of outer layer to be offset minimum 18 in. from butted side joints of base layer.

When **Steel Framing Members** (Item 6B) are used, two layers of nom 5/8 in. thick, 4 ft wide gypsum board are installed with long dimensions perpendicular to furring channels (Item 6Ba). Base layer attached to the furring channels using 1 in. long Type S bugle head steel screws spaced 8 in. OC along butted end joints and 12 in. OC in the field of the board. Butted end joints centered on the continuous furring channels. Butted base layer end joints to be offset a min of 16 in. in adjacent courses. Outer layer attached to the furring channels using 1-5/8 in. long Type S bugle head

steel screws spaced 8 in. OC at butted end joints and 12 in. OC in the field. Butted end joints centered on the continuous furring channels and offset a min of 16 in. from butted end joints of base layer. Butted side joints of outer layer to be offset min 16 in. from butted side joints of base layer.

When **Steel Framing Members** (Item 6E) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, each end of each gypsum board shall be supported by a single length of furring channel equal to the width of the gypsum board plus 3 in. on each end. The two support furring channels shall be spaced approximately 3 in. in from end joint. Screw spacing along the gypsum board butt joint and along both additional channels shall be 8 in. OC. Butt joining furring channels shall be attached with one RESILMOUNT Sound Isolation Clip at each end of the channel.

When **Steel Framing Members*** (Item 6F) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board sheets installed with long dimension (side joints) perpendicular to the 6 ft long cross tees with the end joints staggered min 4 ft and centered between cross tees which are spaced 8 in. OC. Gypsum board side joints may occur beneath or between main runners. Prior to installation of the gypsum board sheets, backer strips consisting of nom 7-3/4 in. wide pieces of gypsum board are to be laid atop the cross tee flanges and centered over each butted end joint location. The backer strips are to be secured to the flanges of the cross tees at opposite corners of the backer strip with hold down clips to prevent the backer strips from being uplifted during screw-attachment of the gypsum board sheets. Gypsum board fastened to cross tees with 1 in. drywall screws spaced 1 in. and 4 in. from the side joints and max 8 in. OC in the field of the board. The butted end joints are to be secured to the backer strip with No. 10 by 1-1/2 in. long Type G laminating screws located 1 in. from each side of the butted end joint and spaced 1 in. and 4 in. from the side joints and max 8 in. OC in the field of the board.

When **Steel Framing Members** (Item 6G) are used, one layer of nom 5/8 in. thick, 4 ft wide gypsum board is installed with long dimensions perpendicular to furring channels. Gypsum board secured to furring channels with nom 1 in. long Type S bugle-head steel screws spaced 8 in. OC in the field of the board. Gypsum board butted end joints shall be staggered minimum 48 in. and centered over main furring channels. At the gypsum board butt joints, an additional single length of furring channel shall be installed and be spaced approximately 3 in. from the butt joint (6 in. from the continuous furring channels) to support the floating end of the gypsum board. Each of these shorter sections of furring channel shall extend one truss beyond the width of the gypsum panel and be attached to the adjacent trusses with one SonusClip at every truss involved with the butt joint.

AMERICAN GYPSUM CO — Types AG-C

CGC INC — Types C, IP-X2, IPC-AR.

CERTAINTED GYPSUM INC — Type C

CERTAINTED GYPSUM INC — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Type TG-C

NATIONAL GYPSUM CO — Types eXP-C, FSW-G, FSW-C, FSK-G, FSK-C.

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR.

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR.

7A. Gypsum Board* — For use with **Steel Framing Members** (Item 6D) when **Batts and Blankets*** (Item 3) are not used - One layer of nom 5/8 in. thick by 48 in. wide boards, installed with long dimension parallel to the main runners. Gypsum board fastened to each cross tee or channel with five gypsum board screws, with one screw located at the midspan of the cross tee or channel, one screw located 12 in. from and on each side of the cross tee or channel mid span and one screw located 1-1/2 in. from each gypsum board side joint. Except at gypsum board end joints, gypsum board screws shall be located on alternating sides of cross tee flange. At

gypsum board end joints, gypsum board screws shall be located 1/2 in. from the joint. Gypsum board fastened to main runners with gypsum board screws 1/2 in. from side joints, midway between intersections with cross tees or channels (16 in. OC). End joints of adjacent gypsum board sheets shall be staggered not less than 32 in. Gypsum board sheets screw attached to leg of wall angle with gypsum board screws spaced 12 in. OC. Joints treated as described in Item 7. For use with **Steel Framing Members*** (Item 6D) when **Batts and Blankets*** (Item 3) are used - 5/8 in. thick, 4 ft wide; installed with long dimension perpendicular to cross tees with side joints centered along main runners and end joints centered along cross tees. Fastened to cross tees with 1 in. long steel gypsum board screws spaced 8 in. OC in the field and 8 in. OC along end joints. Fastened to main runners with 1 in. long gypsum board screws spaced midway between cross tees. Screws along sides and ends of boards spaced 3/8 to 1/2 in. from board edge. End joints of the sheets shall be staggered with spacing between joints on adjacent boards not less than 4 ft OC.

CGC INC — Type C or IP-X2.

UNITED STATES GYPSUM CO — Type C or IP-X2.

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Type C or IP-X2.

7B. Gypsum Board* (As an alternative to Items 7 and 7A) — Nom 5/8 in. thick, 48 in. wide gypsum board, installed and secured as described in Items 7 and 7A with max screw spacing 8 in. OC.

CGC INC — Type ULIX

UNITED STATES GYPSUM CO — ULIX

7C. Gypsum Board* — (As an alternative to Item 7) — For use when no insulation is used. Nom 5/8 in. thick, 48 in. wide gypsum board, installed as described in item 7 with resilient channels (Item 6) spaced 24 in OC.

AMERICAN GYPSUM CO — Type AG-C

8. Finishing System — (Not Shown)— Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads; paper tape, 2 in. wide, embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

9. Netting — (Not Shown) - For use when Sprayed Fiber* (Item 3B) is used - Woven netting material fastened to underside of each truss with staples, with side joints overlapped.

*** 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 2024-06-14

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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

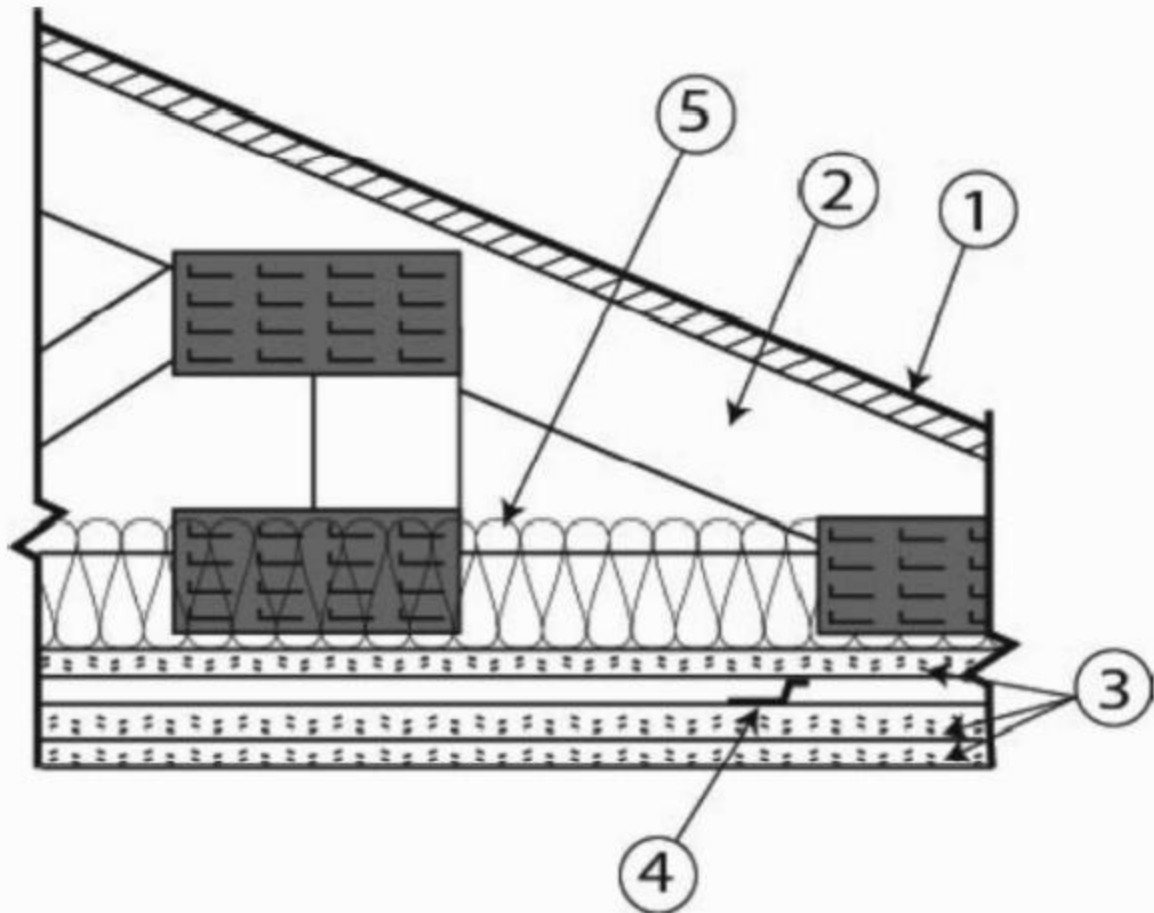
Design No. P571

June 9, 2022

Unrestrained Assembly Rating — 2 Hr.

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. **Roofing System*** — Any UL Class A, B or C Roofing System (**TGFU**) or Prepared Roof Covering (**TFWZ**) acceptable for use over nom 15/32 in. thick wood structural panels, min. grade "C-D" or "Sheathing". Nom 15/32 in. thick wood structural panels secured to trusses with No. 6d ringed shank nails. Nails spaced 12 in. OC along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails. Construction adhesive is optional and may be used with either nails or staples.

2. **Trusses** — Pitch or Parallel chord trusses, spaced a max of 24 in. OC, fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Truss members secured together min. 0.0356 in. thick galv steel plates. Plates have 5/16 in. long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approximately 7/8 in. centers with four rows of teeth per inch of plate width. Minimum parallel chord truss depth shall be 18 in. Where the truss intersects with the interior face of the exterior walls, the min truss depth shall be 3 in. and a min. average depth of 18 in.. Where the truss intersects with the interior face of the exterior walls, batts and blankets shall be firmly packed against the intersection of the bottom chords and the plywood sheathing. Min roof slope of 3/12 unless American Gypsum boards are used, in which case there is no minimum slope.

3. **Gypsum Board*** — Three layers of 5/8 in. thick by 4 ft wide gypsum board. Top layer boards installed with the long dimension perpendicular to trusses with end joints located under bottom of trusses. End joints in adjacent rows shall be staggered on adjacent trusses. Top layer boards secured to bottom chord of trusses with 1-5/8 in. long Type S bugle head screws, spaced max 8 in. OC. Screws located 1-1/2 to 2 in., and 3/4 in. from side and end joints, respectively. Bottom two layers of gypsum board installed perpendicular to furring channels with end joints centered on the furring channels. Middle layer boards secured to each furring channel with 1 or 1-1/4 in. long Type S-12 bugle head steel screws spaced max 8 in. OC. Screws located 1-1/2 to 2 in. and 5/8 to 3/4 in. from side and end joints, respectively. Face layer boards secured to each furring channel through the middle layer with 1-5/8 or 1-7/8 in. long Type S-12 bugle head steel screws, spaced a max of 8 in. OC. Screws located 1-1/2 to 2 in. and 5/8 to 3/4 in. from side and end joints, respectively. End joints and side joints of the face layer boards shall be staggered a min of 16 in. from the joints in the middle layer. If end joints of the face layer boards are not centered on the furring channels, the end of boards at the end joint shall be attached to the middle layer boards with 1-1/2 in. long Type G steel screws spaced 8 in. OC and located 1-1/2 in. from the end joint. All screws shall be driven no further than flush with the face of the boards in order not to damage the core of the boards.

AMERICAN GYPSUM CO — Type AG-C

4. **Furring Channels** — Resilient channels, 1/2 in. deep, or inverted hat type furring channels, 7/8 in. deep, formed from 0.019 in. thick galv steel, spaced 16 in. OC perpendicular to trusses. Channels secured to each truss with 1-7/8 in. long Type S steel screws. When insulation (Items 5 or 5A) is draped over or loose laid over the furring channel/gypsum board ceiling membrane, the furring channel spacing shall be reduced to 12 in. OC.

4A. **Steel Framing Members*** — (Not Shown) — As an alternate to Item 4, 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 trusses. When insulation (Items 5 or 5A) is draped over or loose laid over the furring channel/gypsum board ceiling membrane, the furring channel spacing shall be reduced to 12 in. OC. Channels secured to trusses as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to trusses (Item 2). Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to alternating trusses with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) clips secured to alternating trusses with No. 8 x 1-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels. Adjoining channels are overlapped as described in Item a. As an alternate, ends of adjoining channels may be overlapped 6 in. and secured together with two self-tapping No. 6 framing screws, min 7/16 in. long at the midpoint of the overlap, with one screw on each flange of the channel.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75)

4B. **Steel Framing Members*** — (Not Shown) — As an alternate to Item 4, 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 joists. When insulation (Items 5 or 5A) is draped over or loose laid over the furring channel/gypsum board ceiling membrane, the furring channel spacing shall be reduced to 12 in. OC. Channels secured to joists as described in Item b. Ends of adjoining channels overlapped 6 in. and tied together with double strand of No. 18 SWG galv steel wire near each end of overlap.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the trusses (Item 2). When trusses are spaced 16 or 24 in. OC, clips spaced a max of 48 in. OC. Genie Clips secured to alternating joists with No. 8 x 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

PLITEQ INC — Type Genie Clip

4C. **Alternate Steel Framing Members*** — (Not Shown) — As an alternate to Item 4, furring channels and Steel Framing Members as described below:

a. **Furring Channels** — Formed of No. 25 MSG galv steel, 2-5/8 in. wide by 7/8 in deep, spaced 24 in OC, perpendicular to trusses. When insulation (Items 5 or 5A) is applied over the resilient channel/gypsum panel ceiling membrane, the resilient channel spacing shall be reduced to 12 in. OC. Channels secured to joists as described in Item b.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to the wood trusses (Item 2). Clips spaced at 48" OC and secured to the bottom of the trusses with one 2 in. Coarse Drywall Screw 1 in. diam washer through the center hole. Furring channels are then friction fitted into clips. Ends of channels are overlapped 6" and tied together with double strand of No. 18 AWG galvanized steel wire.

STUDCO BUILDING SYSTEMS — RESILMOUNT Sound Isolation Clips - Types A237 or A237R

5. **Batts and Blankets*** — Any glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance. Insulation secured against the roof, held suspended in the concealed space or draped over the resilient channels (or furring channels) and gypsum panel membrane. Minimum density of 0.5 pcf with no limit on overall thickness.

5A. **Loose Fill Material*** — As an alternate to Item 5, Any loose fill material bearing the UL Classification Marking for Surface Burning Characteristics, having a min density of 0.5 pcf and installed with no limit on overall thickness.

6. **Finishing System** — (Not Shown) — Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads. Nom 2 in. wide paper tape embedded in first layer of compound over all joints. As an alternate, nom 3/32 in. thick veneer plaster may be applied to the entire surface of gypsum board.

*** 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 2022-06-10

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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](#)

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[Design Criteria and Allowable Variances](#)

Design No. **U301**

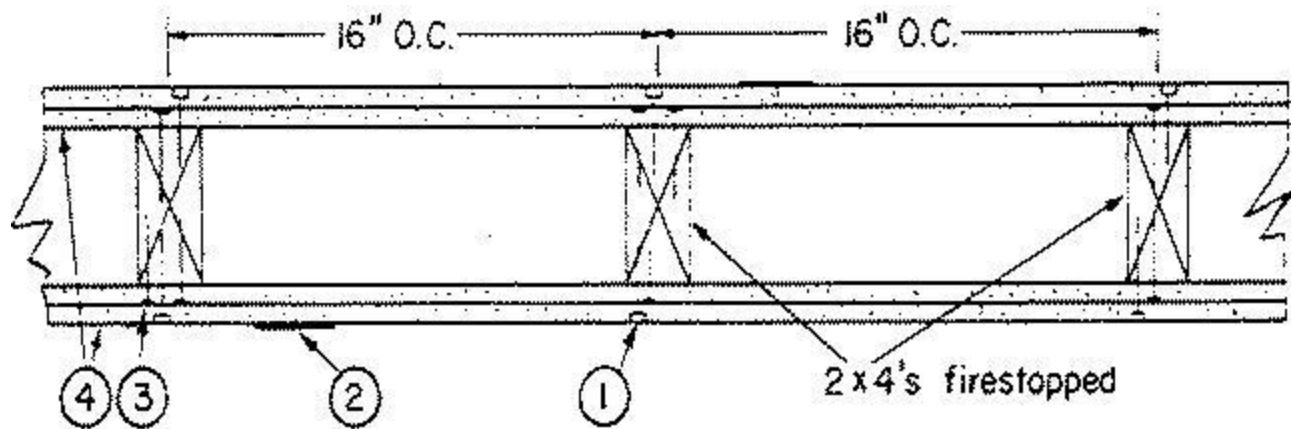
September 10, 2024

Bearing Wall Rating — 2 Hr.

Finish Rating — 66 Min.

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. **Nailheads** — Exposed or covered with joint compound.

2. **Joints** — Exposed joints covered with joint compound and paper tape. Joint compound and paper tape may be omitted when square edge boards are used. As an alternate, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with the joints reinforced with paper tape.

3. **Nails** — 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam, 1/4 in. diam heads, and 8d cement coated nails 2-3/8 in. long, 0.113 in. shank diam, 9/32 in. diam heads.

4. **Gypsum Board*** — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with the 1-7/8 in. nails spaced 6 in. OC. Outer layer attached to studs over inner layer with the 2-3/8 in. long nails spaced 8 in. OC. Vertical joints located over studs. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

When used in widths other than 48 in., gypsum board to be installed horizontally.

When **Steel Framing Members*** (Item 6 or any alternate clips) are used, base layer attached to furring channels with 1 in. long Type S bugle-head steel screws spaced max 24 in. OC; face layer attached with 1-5/8 in. long Type S bugle-head steel screws spaced max 12 in. OC.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, AGX-11, LightRoc

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CABOT MANUFACTURING ULC — Type X, 5/8 Type X, Moisture Resistant Type X, Gypsum Sheathing Type X, Mold & Mildew Resistant Type X and Mold & Mildew Resistant AR Type X, Type Blueglass Exterior Sheathing

CERTAINTED GYPSUM INC — Types EGRG, GlasRoc, GlasRoc-2, Type C, Type X-1, Type LWTX

CGC INC — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULIX, ULX, USGX, WRC, WRX

CERTAINTED GYPSUM INC — Types LGFC2A, LGFC6A, LGFC-C/A, LGFC-WD, LGLLX, CLLX

GEORGIA-PACIFIC GYPSUM L L C — Types 5, 6, 9, C, DAP, DD, DA, DAPC, DGG, DS, GPFS6. LS, TG-C, Type X, Veneer Plaster Base-Type X, Water Rated-Type X, Sheathing Type-X, Soffit-Type X, GreenGlass Type X, Type LWX, Veneer Plaster Base-Type LWX, Water Rated-Type LWX, Sheathing Type-LWX, Soffit-Type LWX, Type DGLW, Water Rated-Type DGLW, Sheathing Type- DGLW, Soffit-Type DGLW, Type LW2X, Veneer Plaster Base - Type LW2X, Water Rated - Type LW2X, Sheathing - Type LW2X, Soffit - Type LW2X, Type DGL2W, Water Rated - Type DGL2W, Sheathing - Type DGL2W

NATIONAL GYPSUM CO — Types eXP-C, FSK, FSK-C, FSK-G, FSW, FSW-3, FSW-5, FSW-6, FSW-8, FSW-C, FSW-G, FSMR-C, FSL, RSX

NATIONAL GYPSUM CO — Riyadh, Saudi Arabia — Type FR, or WR.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-2, PG-3, PG-3W, PG-4, PG-5, PG-5W, PG-5WS, PG-9, PG-11, PG-C, PGS-WRS, PGI

PANEL REY S A — Types PRC, PRC2, PRX, RHX, MDX, ETX, GREX, GRIX

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type C or Type X

UNITED STATES GYPSUM CO — Types AR, C, FRX-G, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULIX, ULX, USGX, WRC, WRX

USG BORAL DRYWALL SFZ LLC — Types C, SCX, USGX

USG MEXICO S A DE C V — Types AR, C, IP-AR, IP-X1, IP-X2, IPC-AR, SCX, SHX, ULX, USGX, WRC, WRX

4A. Gypsum Board* — (As an alternate to Item 4) — Nom 3/4 in. thick, installed as described in Item 4.

CGC INC — Types AR, IP-AR

UNITED STATES GYPSUM CO — Types AR, IP-AR

USG MEXICO S A DE C V — Types AR, IP-AR

4B. Gypsum Board* — (As an alternate to Items 4 and 4A) — 5/8 in. thick, 2 ft wide, tongue and groove edge, applied horizontally as the outer layer to one side of the assembly. Secured as described in Item 4. Joint covering (Item 2) not required.

CGC INC — Type SHX

UNITED STATES GYPSUM CO — Type SHX

USG MEXICO S A DE C V — Type SHX

4C. Gypsum Board* — (As an alternate to Items 4, 4A or 4B — Not Shown) — For Direct Application to Studs Only- For use on one or both sides of the wall as the base layer or one or both sides of the wall as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-12 pan head steel screws, F4j.one at the top of the strip and one at the bottom of the strip. Lead discs or tabs may be used in lieu of or in addition to the lead batten strips or optional at other locations. Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards underneath screw locations prior to the installation of the screws. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RAY-BAR ENGINEERING CORP — Type RB-LBG.

4D. Gypsum Board* — As an Alternate to Item 4 — 5/8 in. thick applied either horizontally or vertically. Inner layers 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. Outer layers fastened to framing with 1-7/8 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 other than 48 in., gypsum board to be installed horizontally. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, LightRoc

4E. Gypsum Board* — (As an alternate to Items 4 through 4D) — 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically and secured as described in Item 4.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board

4F. Gypsum Board* — (As an alternate to Item 4) — Not to be used with item 6, 6A, 6B or 6C. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically and secured as described in Item 4.

NATIONAL GYPSUM CO — Type SBWB

4G. Gypsum Board * — (As an alternate to Items 4 through 4F) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 4.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types QuietRock ES

4H. Gypsum Board* — (As an alternate to Item 4) — Not to be used with item 6, 6A, 6B, or 6C. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically or horizontally and secured as described in Item 4.

CERTAINTED GYPSUM INC — Type SilentFX

4I. Gypsum Board* — (As an alternate to item 4) — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with 1-1/4 in. long Type W steel screws spaced 8 in. OC. Outer layer attached to studs over inner layer with 2 in. long Type W steel screws spaced 8 in. OC offset 6 in. from base layer. Vertical joints located over studs. Vertical and horizontal joints between inner and outer layers staggered. Outer layer joints covered with joint tape and compound, screwheads covered with joint compound. As an alternate to the joint compound nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard. Joints reinforced. Wallboard other than 48 in. wide must be applied horizontally. The SoundBreak XP Type X Gypsum Board is not to be used with Item 6, 6A, 6B, or 6C.

NATIONAL GYPSUM CO — Types eXP-C, FSK, FSK-C, FSK-G, FSW, FSW-3, FSW-5, FSW-6, FSW-C, FSW-G, FSMR-C, SBWB

4J. Gypsum Board* — (As an alternate to Items 4) — For Direct Application to Studs Only- For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 10 ft long with a max thickness of 0.140 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, max 5/16 in. diam by max 0.140 in. thick. compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

MAYCO INDUSTRIES INC — "X-Ray Shielded Gypsum"

4K. Gypsum Board* — For use with Item 7 — 5/8 in. thick, two layers applied vertically. Inner layer attached to resilient channels with 1 in. long steel screws spaced 8 in. OC. Outer layer attached to resilient channels over inner layer with 1-5/8 in. long steel screws spaced 8 in. OC. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side. Insulation, Items 8 or 9 is required.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, AGX-11

NATIONAL GYPSUM CO — Types eXP-C, FSK, FSK-C, FSK-G, FSW, FSW-3, FSW-5, FSW-6, FSW-C, FSW-G, FSMR-C, SBWB.

CERTAINTED GYPSUM INC — Types EGRG, GlasRoc, GlasRoc-2, Type C, Type X-1, Easi-Lite Type X, SilentFX

4L. Gypsum Board* — (As an alternate to Items 4) — For Direct Application to Studs Only- For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

4M. Gypsum Board* — (As an alternate to Item 4) — 5/8 in. thick, 4 ft. wide, two layers applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 4.

CERTAINTED GYPSUM INC — 5/8" Easi-Lite Type X

4N. Gypsum Board* — (As an alternate to 5/8 in. Type FSW in Items 4 or 4I) — Nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Two layers of 5/16 in. for every single layer of 5/8 in. gypsum board described in Item 4 or 4I. Horizontal joints on the same side need not be staggered. Inner layer of each double 5/16 in. layer attached with fasteners, as described in item 4 or 4I, spaced 24 in. OC. Outer layer of each double 5/16 in. layer attached per Item 4 or 4I.

NATIONAL GYPSUM CO — Type FSW

4O. Wall and Partition Facings and Accessories* — (As an alternate to Items 4 through 4N) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 4.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527

4P. Gypsum Board* — (As an alternate to Item 4) — 5/8 in. thick, two layers applied either horizontally or vertically. Inner layer attached to studs with 1-1/4 in. long Type W steel screws spaced 10 in. OC with the last two screws 4 and 1 in. from the edges of the board. Outer layer attached to studs over inner layer with 1-7/8 in. long Type W steel screws spaced 10 in. OC offset 5 in. from base layer with the last two screws 4 and 1 in. from the edges of the board. Vertical joints located over studs. Vertical and horizontal joints between inner and outer layers staggered. Outer layer joints covered with joint tape and compound, screwheads covered with joint compound. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

CERTAINTED GYPSUM INC — Type LGFC6A, Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

4Q. Gypsum Board* — (As an alternate to Item 4. For use with Item 13) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board UL Classified for Fire Resistance (CKNX) eligible for use in Design Nos. U305 and L501 or G512. Two layers, applied either horizontally or vertically, and screwed to studs with 1-5/8 in. long Type W coarse thread steel screws at 8 in. OC at perimeter and in the field with the last two

screws 4 and 3/4 in. from the edges of the board when applied as the base layer. For the face layer, screw length to be increased to 2-1/2 in. All joints in face layers staggered with joints in base layers. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

4R. Gypsum Board* — As an Alternate to Item 4 — 5/8 in. thick applied either horizontally or vertically. Inner layers 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. Outer layers fastened to framing with 1-7/8 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 other than 48 in., gypsum board to be installed horizontally. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

CERTAINTED GYPSUM INC — Types EGRG, GlasRoc, GlasRoc-2, Type C, Type X-1, Easi-Lite Type X, SilentFX

4S. Gypsum Board* — (As an alternate to Item 4. For use with Item 13A) — 5/8 in. thick, two layers applied vertically. Inner layer attached to studs with the 1-7/8 in. nails spaced 6 in. OC. Outer layer attached to studs over inner layer with the 2-3/8 in. long nails spaced 8 in. OC. Vertical joints located over studs. All joints in face layers staggered with joints in base layers. Joints of each base layer offset with joints of base layer on opposite side.

AMERICAN GYPSUM CO — Types AGX-1

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CABOT MANUFACTURING ULC — "5/8 Type X"

CGC INC — Type SCX

PANEL REY S A — Type PRX

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type X

UNITED STATES GYPSUM CO — Type SCX

USG BORAL DRYWALL SFZ LLC — Types SCX

USG MEXICO S A DE C V — Type SCX

4T. Gypsum Board* — (As an alternate to Item 4. For use with Item 13B) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 4 above. Two layers applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. All joints in outer layers staggered with joints in inner layers. Inner layer attached to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field. Outer layer attached to studs over inner layer with the 2-1/2 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC.

4U. Gypsum Board* — (As an alternate to Item 4. For use with Item 13C) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 4 above. Two layers applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. All joints in outer layers staggered with joints in inner layers. Inner layer attached to studs with 1-1/4 in. long Type W screws spaced 8 in. OC at perimeter and in the field. Outer layer attached to studs over inner layer with 1-7/8 in. long Type W screws spaced 8 in. OC.

5. Molded Plastic* — Not Shown, Optional — Solid vinyl siding mechanically secured over the outer layer to framing members in accordance with manufacturer's recommended installation details.

ALSIDE, DIV OF ASSOCIATED MATERIALS INC

6. **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. Wallboard attached to furring channels as described in Item 4.

B. **Steel Framing Members*** — Used to attach furring channels (Item 6a) 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)

6A. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — 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 4.

B. **Steel Framing Members*** — Used to attach furring channels (Item 6Aa) 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

6B. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — 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 6Bb. 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 4.

B. **Steel Framing Members*** — Used to attach furring channels (Item 6Ba) to studs. Clips spaced 48 in. OC., and secured to studs with 2-1/2 in. coarse drywall screw through the center hole. Furring channels are friction fitted into clips.

REGUPOL AMERICA — Type SonusClip

6C. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — 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 4.

b. **Steel Framing Members*** — Used to attach resilient channels (Item 6Ca) 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

6D. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — Used as an alternate method to attach resilient channels to wall studs. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and

spaced max 24 in. O.C. Channel ends butted and centered under the structural members and attached with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the structural members with the screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Type RC-1 Boost

6E Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 6) — 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. 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 4.

b Steel Framing Members* — Used to attach furring channels (Item 6Ea) 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

7. Furring Channel — Optional — Not Shown — For use on one side of the wall with Item 4K — Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Item 8 or 9 is required.

8. Batts and Blankets* — Required for use with resilient channels, Item 7, min. 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the nom 4 in. face of the studs with staples placed 24 in. OC.

ROCKWOOL — Type SAFEnSOUND, min. 1.8 pcf.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

9. Batts and Blankets* — (As an alternate to Item 8) — Min. 3 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, friction-fitted to fill the stud cavities. See Batts and Blankets (BKNV or BZJZ) Categories for names of Classified companies.

9A. Fiber, Sprayed* — (Optional) — As an alternate to Batts and Blankets (Item 8), Required for use with resilient channels, Item 7, Not for use with Item 6, 6A, 6B, or 6C. — Spray applied mineral wool insulation. 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

10. Wall and Partition Facings and Accessories* — (Optional, Not Shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 or QR-510

11. Cementitious Backer Units* — (Optional Item Not Shown — For Use On Face Of 2 Hr Systems With All Standard Items Required) — 7/16 in., 1/2 in., 5/8 in., 3/4 in. or 1 in. thick, min. 32 in. wide. Applied horizontally or vertically with vertical joints centered over studs. Face layer fastened over gypsum board to studs and runners with cement board screws of adequate length to penetrate stud by a minimum of 3/8 in. for steel framing members, and a minimum of 3/4 in. for wood framing members spaced a max of 8 in. OC.

NATIONAL GYPSUM CO — Type DuraBacker, PermaBase, DuraBacker Plus, or PermaBase Plus

12. Wall and Partition Facings and Accessories* — (Optional, Not Shown) - When the Wall Assembly is used as an External Wall, on the External side of the wall one of the following Wall and Partition and Facing Accessories may be used, refer to items (A) to (C) below.

A. Non Insulated system with metal channels — Install moisture barrier over the Gypsum Board Item 4 and Install Acry Metal Channels vertically at a horizontal spacing not greater than 24 inches OC., over the moisture barrier. Acry Metal Channels attached through the moisture barrier and the Gypsum Board to the Wood Studs using fasteners specified by the manufacturer and fasteners spaced max., 24 in. OC. Install Acrytec Panels on Acry Metal Channels using 1-1/4" long corrosion coated stainless steel screws spaced at a max spacing of 24 inches OC, along with manufacturer's approved adhesive (3M 540 or Tremco Vulcum 116). Adhesive to be applied in a zigzag pattern along every channel. Joint treatment in between panels shall be Tremco illmod 600 pre compressed polyurethane foam sealant.

B. Insulated system with metal channels — Install moisture barrier over the Gypsum Board Item 4. Install galvanized Z girt channels specified by the manufacturer over the moisture barrier and the Gypsum Board Item 4. Z girt channels to be installed horizontally at a max. spacing of 24" OC. Z girt channels attached through the Gypsum Board and the moisture barrier to the wood studs with screws provided by the manufacturer at a max spacing of 24 inches OC. Install mineral wool insulation between the Z girts. Maximum thickness of mineral wool insulation not to exceed 6 in. As per manufacturer's instructions install Acry Metal Channels vertically over the Z girts at a max horizontal spacing of 24 in. OC. Acrytec Panels installed on Acry channel with 1-1/4" long corrosion coated stainless steel screws at a max spacing of 24 in. OC, along with manufacturers approved adhesive (3M 540 or Tremco Vulcum 116). Adhesive to be applied in a zigzag pattern along every channel. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

C. Non insulated wood strapping system — Install moisture barrier over the Gypsum Board Item 4 and Install 1" x 3" wood strapping vertically at a horizontal spacing not greater than 24 inches OC., over the moisture barrier. 1" x 3" wood strapping attached through the moisture barrier and the Gypsum Board to the Wood studs using fasteners specified by the manufacturer and fasteners spaced max., 24 in. OC. Acrytec Panels to be installed on the 1" x 3" wood strapping using manufacturers approved stainless steel fasteners spaced at maximum 24 inches OC along with Tremco Vulcum 116 adhesive applied in a zigzag pattern along every wood strap. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

D. Insulated Wood Strapping System — Install moisture barrier over the Gypsum Board Item 4. Install Extruded Polystyrene Insulation over moisture barrier and the Gypsum Board Item 4, max thickness of insulation not to exceed 4 inches. Install 1" x 3" wood strapping vertically at a horizontal spacing not greater than 24 inches OC. Wood strapping attached through the Insulation, the Gypsum Board and moisture barrier to the Wood Studs using fasteners specified by the manufacturer and fasteners spaced max. 24 in. OC. Acrytec Panels to be installed over the wood strapping using manufacturers approved stainless steel fasteners at a max spacing of 24 in. OC and Tremco Vulcum 116 adhesive applied in a zigzag pattern along every wood strap. Joint treatment in between panels to be Tremco illmod 600 pre compressed polyurethane foam sealant.

ACRYTEC PANEL INDUSTRIES — Nominal 5/8 inch thick Acrytec Panel.

13. Foamed Plastic* — (Optional, Not Shown - For use with Item 4Q) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

Holcim Solutions and Products US, LLC — Nexseal™ 2.0 or Nexseal™ 2.0 LE Spray Foam and Sucraseal Spray Foam. For use in Bearing and Non-Load Bearing Walls.

13A. Foamed Plastic* — (Optional, Not Shown - For use with Item 4S) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

HOLCIM SOLUTIONS AND PRODUCTS US, LLC — Types GacoEZSpray F4500, GacoProFill FR6500R, Gaco 052N, GacoOnePass F1850, GacoOnePass Low GWP F1880, and Gaco WallFoam 183M.

13B. Foamed Plastic* — (Optional, Not Shown - For use with Item 4T) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

CARLISLE SPRAY FOAM INSULATION — Types SealTite ONE, SealTite Pro Closed Cell (CC), SealTite Pro Open Cell (OC), SealTite Pro OCX, SealTite Pro No Trim 21, SealTite Pro One Zero, Foamsulate Closed Cell, Foamsulate OCX, Foamsulate 70, and Foamsulate HFO.

13C. Foamed Plastic* - (Optional, Not Shown – For use with Item 4U) - Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

BASF CORP – Types Enertite® NM, Enertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US , Walltite® US-N, Walltite® HP+, Spraytite® Comfort XL, Walltite® XL, , Walltite® MAX, Walltite® LWP, Walltite® Plus and Enertite® Max

14. Foamed Plastic* — (Optional, Not Shown - For use over Gypsum Board, Item 4) - Polyisocyanurate foamed plastic boards, any thickness applied vertically with vertical joints located over studs. May be used with Molded Plastic, Item 5 or any exterior facing, as authorized by the Authority Having Jurisdiction and installed in accordance with the manufacturer's installation instructions.

HUNTER PANELS, A DIVISION OF CARLISLE CONSTRUCTION MATERIALS, LLC — "Xci Class A", "Xci 286", "Xci Foil (Class A)", "Xci CG", "Xci Foil", "Xci CG NH", "Xci Foil NH"

ATLAS ROOFING CORP — "EnergyShield®", "EnergyShield® CGF", "EnergyShield® XR", "EnergyShield® Pro Wall Insulation", "EnergyShield® CGF Pro", "EnergyShield® Ply Pro"

15. Building Units* — (Optional, Not Shown - For use over Gypsum Board, Item 4) Polyisocyanurate composite foamed plastic boards, any thickness, applied vertically with vertical joints located over studs. May be used with Molded Plastic, Item 5 or any exterior facing, as authorized by the Authority Having Jurisdiction and installed in accordance with the manufacturer's installation instructions.

HUNTER PANELS, A DIVISION OF CARLISLE CONSTRUCTION MATERIALS, LLC — "Xci NB", "Xci Ply"

ATLAS ROOFING CORP — "EnergyShield® Ply"

16. Building Units – (Optional Item Not Shown – For use over Gypsum Board, Item 4) 1 in., 2 in. or 3 in. thick, 4 ft. wide – Applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with wafer head screws of adequate length to penetrate framing by a minimum of of ¾ in., spaced a max 8 in. o.c.

NATIONAL GYPSUM CO – Type PBCI

*** 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 2024-09-10

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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. U305

June 14, 2024

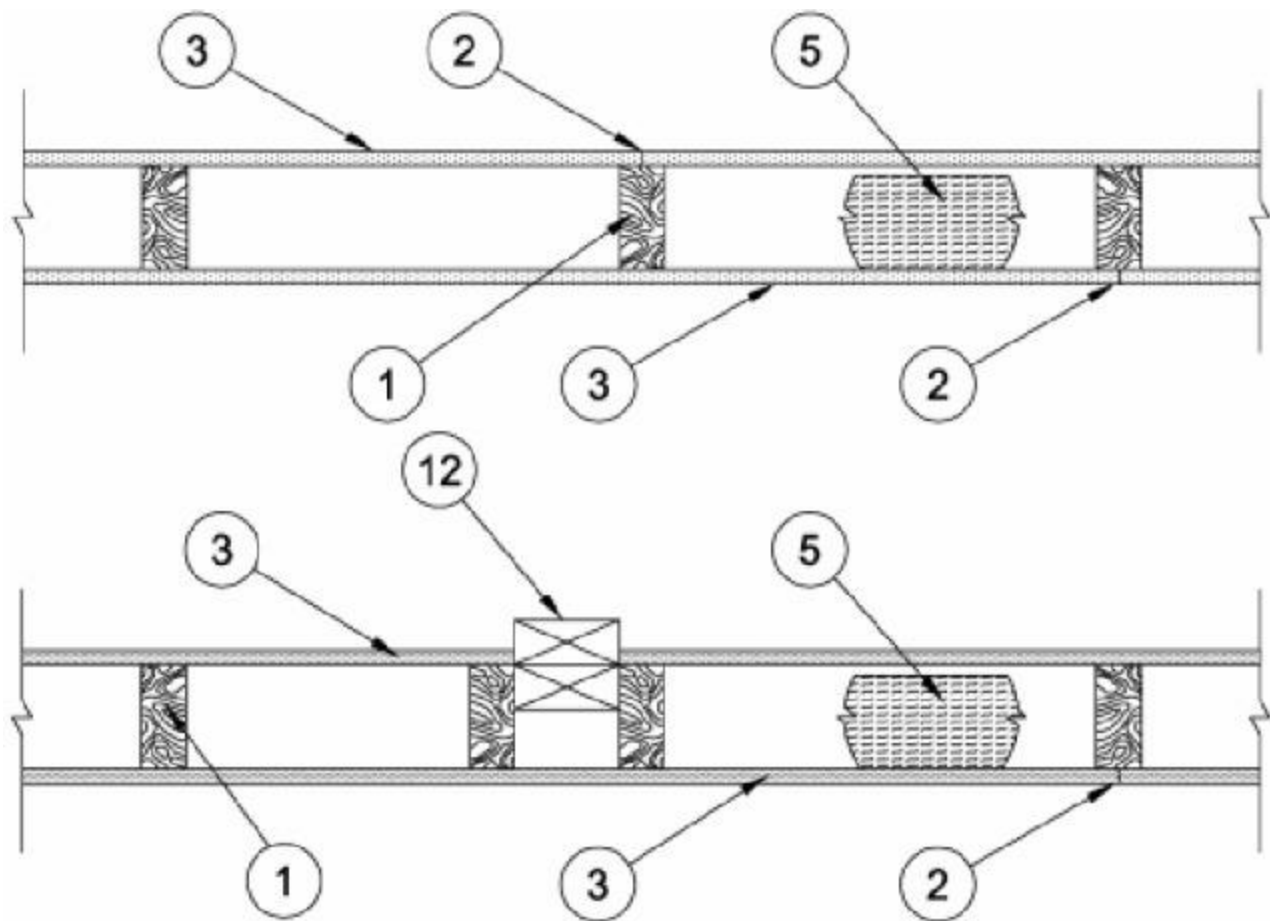
Bearing Wall Rating — 1 Hr

Finish Rating — See Items 3, 3A, 3D, 3E, 3F, 3G, 3H, 3J and 3L.

STC Rating - 56 (See Item 9)

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 max, effectively firestopped.

2. **Joints and Nail-Heads** — Joints covered with joint compound and paper tape. Joint compound and paper tape may be omitted when square edge boards are used. As an alternate, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with the joints reinforced with paper tape. Nailheads exposed or covered with joint compound.

3. **Gypsum Board*** — 5/8 in. thick paper or vinyl surfaced, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. When used in widths other than 48 in., gypsum panels are to be installed horizontally. For an alternate method of attachment of gypsum panels, refer to Items 6 through 6F, **Steel Framing Members***.

When Items 6, 6B, 6C, 6D, 6E, or 6F, **Steel Framing Members***, are used, gypsum panels attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When Item 6A, **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. One layer of gypsum board attached to opposite side of wood stud without furring channels as described in Item 3.

When Item 7, resilient channels are used, 5/8 in. thick, 4 ft wide gypsum panels applied vertically. Screw attached furring channels with 1 in. long, self-drilling, self-tapping Type S or S-12 steel screws spaced 8 in. OC, vertical joints located midway between studs.

AMERICAN GYPSUM CO — Types AGX-1(finish rating 23 min.), M-Glass (finish rating 23 min.), Type AGX-11 (finish rating 26 min), Type AGX-12 (finish rating 22 min), Type LightRoc (finish rating 23 min.) or Type AG-C

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1 (finish rating 24 min)

CABOT MANUFACTURING ULC — Type X (finish rating 22 min), 5/8 Type X, Moisture Resistant Type X, Gypsum Sheathing Type X, Mold & Mildew Resistant Type X and Mold & Mildew Resistant AR Type X, Type Blueglass Exterior Sheathing

CERTAINTED GYPSUM INC — Type C, Type X-1 (finish rating 26 min); Type EGRG or GlasRoc (finish rating 23 min), GlasRoc-2, Type Habito (finish rating 26 min), Type LWTX (finish rating 18 min), Type LGFC6A (finish rating 34 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX (finish rating 21 min), Type CLLX (finish rating 24 min)

CGC INC — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SCX (finish rating 24 min), Type SHX (finish rating 24 min), Type ULX (finish rating 22 min), Type WRC (finish rating 24 min), Type WRX (finish rating 24 min), Type ULIX (finish rating 20 min)

GEORGIA-PACIFIC GYPSUM L L C — Type 5 (finish rating 26 min), Type 6 (finish rating 23 min), Type 9 (finish rating 26 min), Type C (finish rating 26 min), Type DGG (finish rating 20 min), Type GPFS1 (finish rating 20 min), Type GPFS2 (finish rating 20 min), Type GPFS6 (finish rating 26 min), Type DS, Type DAP, Type DD (finish rating 20 min), Type DA, Type DAPC, Type LS (finish rating 23 min), Type X, Veneer Plaster Base - Type X, Water Rated - Type X, Sheathing - Type X, Soffit - Type X, Type LWX (finish rating 22 min), Veneer Plaster Base-Type LWX (finish rating 22 min), Water Rated-Type LWX (finish rating 22 min), Sheathing Type-LWX (finish rating 22 min), Soffit-Type LWX (finish rating 22 min), Type DGLW (finish rating 22 min), Water Rated-Type DGLW (finish rating 22 min), Sheathing Type- DGLW (finish rating 22 min), Soffit-Type DGLW (finish rating 22 min), Type LWX (finish rating 22 min), Type LW2X (finish rating 22 min), Veneer Plaster Base - Type LW2X (finish rating 22 min), Water Rated - Type LW2X (finish rating 22 min), Sheathing - Type LW2X (finish rating 22 min), Soffit - Type LW2X (finish rating 22 min), Type DGL2W (finish rating 22 min), Water Rated - Type DGL2W (finish rating 22 min), Sheathing - Type DGL2W (finish rating 22 min)

NATIONAL GYPSUM CO — Type FSK (finish rating 20 min), Type FSK-G (finish rating 20 min), Type FSW (finish rating 20 min), Type FSW-2 (finish rating 24 min), Type FSW-3 (finish rating 20 min), Type FSW-5 (finish rating 22 min), Type FSW-G (finish rating 20 min), Type FSK-C (finish rating 20 min), Type FSW-C (finish rating 20 min), Type FSMR-C, Type FSW-6 (finish rating 20 min), Type FSL (finish rating 24 min), Type FSW-8, Type FSLX (finish rating 21 min), Type RSX (finish rating 26 min).

NATIONAL GYPSUM CO — Riyadh, Saudi Arabia — Type FR, or WR.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types C, PG-2 (finish rating 20 min), PG-3 (finish rating 20 min), Types PG-3W, PG-5W (finish rating 20 min), Type PG-4 (finish rating 20 min), Type PG-6 (finish rating 23 min), Types PG-3WS, PG-5WS, PGS-WRS (finish rating 20 min), Types PG-5, PG-9 (finish rating 26 min), PG-11 PG-13 (Nails increased to 2 in.), Type PG-C or PGI (finish rating 26 min)

PANEL REY S A — Type ARX, GREX, GRIX, PRX, PRC, PRC2; Types RHX, Guard Rey, MDX, ETX (finish rating 22 min), PRX2 (finish rating 21 min)

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1 (finish rating 26 min)

THAI GYPSUM PRODUCTS PCL — Type C, Type X (finish rating 26 min)

UNITED STATES GYPSUM CO — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type FRX-G (finish rating 29 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), Type SGX (finish rating 24 min), Type ULX (finish rating 22 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type ULIX (finish rating 20 min), Type SCX (finish rating 24 min)

USG BORAL DRYWALL SFZ LLC — Type SGX (finish rating 24 min).

USG MEXICO S A DE C V — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), SCX (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type ULX (finish rating 22 min)

3A. Gypsum Board* — (As an alternate to Item 3) — 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.), LighttRoc (finish rating 25 min.)

CERTAINTED GYPSUM INC — Type C, Type X-1 (finish rating 26 min), Type EGRG or GlasRoc, LWTX.

CGC INC — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SCX (finish rating 24 min), Type SHX (finish rating 24 min), Type WRC (finish rating 24 min), Type WRX (finish rating 24 min)

NATIONAL GYPSUM CO — Type FSW (finish rating 24 min)

UNITED STATES GYPSUM CO — Type AR (finish rating 24 min), Type SGX (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SCX (finish rating 24 min), Type SHX (finish rating 24 min), Type FRX-G (finish rating 24 min), Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min)

USG BORAL DRYWALL SFZ LLC — Types C, SCX, SGX (finish rating 24 min).

USG MEXICO S A DE C V — Type AR (finish rating 24 min), Type C (finish rating 24 min), Type WRX (finish rating 24 min), Type WRC (finish rating 24 min), Type IP-X1 (finish rating 24 min), Type IP-X2 (finish rating 24 min), Type SHX (finish rating 24 min), Type SCX, Type IP-AR (finish rating 24 min), Type IPC-AR (finish rating 24 min)

3B. Gypsum Board* — (As an alternate to Item 3) — Nom 3/4 in. thick, installed with 1-7/8 in. long cement coated nails as described in Item 3 or 1-3/8 in. long Type W coarse thread gypsum panel steel screws as described in Item 3A.

CGC INC — Types AR, IP-AR

UNITED STATES GYPSUM CO — Types AR, IP-AR

USG MEXICO S A DE C V — Types AR, IP-AR

3C. Gypsum Board* — (As an alternate to Items 3, 3A and 3B) — 5/8 in. thick, 2 ft wide, tongue and groove edge, applied horizontally to one side of the assembly. Installed with 1-7/8 in. long cement coated nails as described in Item 3 or 1-1/4 in. long Type W coarse thread gypsum panel steel screws as described in Item 3A. Joint covering (Item 2) not required.

CGC INC — Type SHX

UNITED STATES GYPSUM CO — Type SHX

USG MEXICO S A DE C V — Type SHX

3D. Gypsum Board* — (As an alternate to Items 3, 3A, 3B, or 3C — Not Shown) — For Direct Application to Studs Only- Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 1-1/2 in. wide, max 10 ft long with a max thickness of 0.125 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs or tabs may be used in lieu of or in addition to the lead batten strips or optional at other locations. Max 3/4 in. diam by max 0.125 in. thick lead discs compression fitted or adhered over steel screw heads or max 1/2 in. by 1-1/4 in. by max 0.125 in. thick lead tabs placed on gypsum boards underneath screw locations prior to the installation of the screws. Lead batten strips to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C".

RAY-BAR ENGINEERING CORP — Type RB-LBG (finish rating 24 min)

3E. **Gypsum Board*** — (As an alternate to Items 3, 3A, 3B, 3C, and 3D) — 5/8 in. thick gypsum panels, with square 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 2 screws 1 and 4 in. from edge of board or nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

GEORGIA-PACIFIC GYPSUM L L C — Type DGG (finish rating 20 min), GreenGlass Type X (finish rating 23 min)

3F. **Gypsum Board*** — (As an alternate to Items 3, 3A, 3B, 3C, 3D, and 3E) — 5/8 in. glass-mat faced with square edges, applied either horizontally or vertically. Gypsum panels nailed 7 in. OC around the perimeter and in the field with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Nails shall be placed 1 inch and 3 inch from horizontal joints and 7 inch OC thereafter.

CGC INC — Type USGX (finish rating 22 min)

UNITED STATES GYPSUM CO — Type USGX (finish rating 22 min.)

USG BORAL DRYWALL SFZ LLC — , Type USGX (finish rating 22 min.)

USG MEXICO S A DE C V — Type USGX (finish rating 22 min.)

3G. **Gypsum Board*** — (As an alternate to Items 3 through 3F) — 5/8 in. thick paper surfaced applied vertically. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min)

3H. **Gypsum Board*** — (As an alternate to Items 3) — Not to be used with items 6 or 7. 5/8 in. thick paper surfaced applied vertically only. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads.

NATIONAL GYPSUM CO — Type SBWB

3I. **Gypsum Board*** — (As an alternate to Items 3 through 3H, Not Shown) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically. Panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Panel joints covered with paper tape and two layers of joint compound. Nailheads covered with two layers of joint compound.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock ES (finish rating 20 min)

3J. **Gypsum Board*** — (As an alternate to Item 3) — 5/8 in. thick paper surfaced applied vertically or horizontally. Gypsum panels secured with 1-1/4 in. Type W coarse thread gypsum panel steel screws spaced a maximum of 12 in. OC.

CERTAINTED GYPSUM INC — Type SilentFX

3K. **Gypsum Board*** — (As an alternate to Item 3) — 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 8 in. OC with the last screw 1 in. from the edge of the board. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

NATIONAL GYPSUM CO — Type FSK (finish rating 20 min), Type FSK-G (finish rating 20 min), Type FSW (finish rating 20 min), Type FSW-2 (finish rating 24 min), Type FSW-3 (finish rating 20 min), Type FSW-5 (finish rating 22 min), Type FSW-G (finish rating 20 min), Type FSK-C (finish rating 20 min), Type FSW-C (finish rating 20 min), Type FSMR-C, Type FSW-6 (finish rating 20 min), Type FSL (finish rating 24 min).

3L. Gypsum Board* — (As an alternate to Item 3) — For Direct Application to Studs Only — Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 10 ft long with a max thickness of 0.140 in. placed on the face of studs and attached to the stud with two 1 in. long Type S-8 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, max 5/16 in. diam by max 0.140 in. thick. compression fitted or adhered over the screw heads. Lead batten strips to have a purity of 99.5% meeting the Federal specification QQ-L-201f, Grades "B, C or D".

MAYCO INDUSTRIES INC — "X-Ray Shielded Gypsum"

3M. Gypsum Board* — (As an alternate to Items 3) — For Direct Application to Studs Only — For use as the base layer or as the face layer. Nom 5/8 in. thick lead backed gypsum panels with beveled, square or tapered edges, applied vertically. Vertical joints centered over studs and staggered min 1 stud cavity on opposite sides of studs. Wallboard secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field when applied as the base layer. When applied as the face layer screw length to be increased to 2-1/2 in. Lead batten strips required behind vertical joints of lead backed gypsum wallboard and optional at remaining stud locations. Lead batten strips, min 2 in. wide, max 8 ft long with a max thickness of 0.14 in. placed on the face of studs and attached to the stud with construction adhesive and two 1 in. long Type S-12 pan head steel screws, one at the top of the strip and one at the bottom of the strip. Lead discs, nominal 3/8 in. diam by max 0.085 in. thick. Compression fitted or adhered over the screw heads. Lead batten strips and discs to have a purity of 99.9% meeting the Federal specification QQ-L-201f, Grade "C". Fasteners for face layer gypsum panels (Items 4, 4A or 4B) when installed over lead backed board to be min 2-1/2 in. Type S-12 bugle head steel screws spaced as described in Item 4.

RADIATION PROTECTION PRODUCTS INC — Type RPP - Lead Lined Drywall

3N. Gypsum Board* — (As an alternate to Item 3) — 5/8 in. thick, 4 ft. wide, applied horizontally or vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 3 or 3A.

CERTAINTED GYPSUM INC — Easi-Lite Type X (finish rating 24 min), Easi-Lite Type X-2 (finish rating 24 min)

3O. Wall and Partition Facings and Accessories* — (As an alternate to Item 3, Not Shown) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically. Panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads. Panel joints covered with paper tape and two layers of joint compound. Nailheads covered with two layers of joint compound.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527 (finish rating 24 min).

3P. Gypsum Board* — (As an alternate to Item 3, Not Shown) — Two layers nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Horizontal edge joints and horizontal butt joints on opposite sides of studs need not be staggered or backed by wood studs. Horizontal joints on the same side between face and base layers need not be staggered. Base layer gypsum panels fastened to studs with 1-1/4 in. long drywall nails spaced 8 in. OC. Face layer gypsum panels fastened to studs with 1-7/8 in. long drywall nails spaced 8 in. OC starting with a 4" stagger.

NATIONAL GYPSUM CO — Type FSW (finish rating 25 min)

3Q. Gypsum Board* — (As an alternate to Item 3) — 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.

CERTAINTED GYPSUM INC — Type LGFC6A (finish rating 21 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

3R. **Gypsum Board*** — (As an alternate to Item 3. For use with Item 5H) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 3 above. Applied either horizontally or vertically, and screwed to panels with 1-5/8 in. long Type W coarse thread steel screws at 8 in. OC at perimeter and in the field with the last two screws 4 and 3/4 in. from the edges of the board when applied as the base layer. When used in widths other than 48 in., gypsum panels are to be installed horizontally.

3S. **Gypsum Board*** — 3/4 in. thick paper or vinyl surfaced, with beveled, square, or tapered edges, applied either horizontally or vertically. Gypsum panels secured as described in Item 3 with nail length increased to 2 in.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-13

3T. **Wall and Partition Facings and Accessories*** — (As an alternate to 5/8 in. thick board as outlined in Item 3) — Nominal 1-3/8 in. thick, 4 ft wide panels, applied vertically or horizontally. Fastened with #6 x 2 in. long drywall screws spaced 8 in. OC along the perimeter and 12 in. OC in the field.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 545

3U. **Gypsum Board*** — (As an alternate to Item 3 - For use with Foamed Plastic products, Item 5J) — 5/8 in. thick, 4 ft. wide, applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Gypsum panels nailed 7 in. OC with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 15/64 in. diam heads.

AMERICAN GYPSUM CO — Types AGX-1

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CABOT MANUFACTURING ULC — Type X

CERTAINTED GYPSUM INC — Type X

CGC INC — Type SCX

PANEL REY S A — Type ARX, PRX

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type X

UNITED STATES GYPSUM CO — Types SCX and SGX

USG BORAL DRYWALL SFZ LLC — Types SCX and SGX

USG MEXICO S A DE C V — Type SCX

3V. **Gypsum Board*** — (As an alternate to Item 3. For use with Item 5K) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 3 above. Applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Gypsum panels secured to studs with 1-5/8 in. long Type W coarse thread gypsum panel steel screws spaced 8 in. OC at perimeter and in the field.

3W. **Gypsum Board*** — (As an alternate to Item 3. For use with Item 5L) — Any 5/8 in. thick, 4 ft. wide, Gypsum Board listed in Item 3 above. Applied vertically with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Gypsum panels secured to studs with 1-1/4 in. long Type W screws spaced 8 in. OC at perimeter and in the field.

4. **Steel Corner Fasteners** — (Optional) — For use at wall corners. Channel shaped, 2 in. long by 1 in. high on the back side with two 1/8 in. wide cleats protruding into the 5/8 in. wide channel, fabricated from 24 gauge galv steel. Fasteners applied only to the end or cut edge (not along tapered edges) of the gypsum board, no greater than 2 in. from corner of gypsum board, max spacing 16 in. OC. Nailed to adjacent stud through tab using one No. 6d cement coated nail per fastener. Corners of wall board shall be nailed to top and bottom plate using No. 6d cement coated nails.

5. **Batts and Blankets*** — (Optional — Required when Item 6A is used (RC-1)) — Glass fiber or mineral wool insulation. Placed to completely or partially fill the stud cavities. When Item 6A is used, glass fiber or mineral wool insulation shall be friction-fitted to completely fill the stud cavities.

CERTAINTED CORP

JOHNS MANVILLE

KNAUF INSULATION LLC

MANSON INSULATION INC

ROCKWOOL — Types Acoustical Fire Batts and Type AFB, min. density 1.69 pcf / 27.0 kg/m³

ROCKWOOL MALAYSIA SDN BHD — Type Acoustical Fire Batts

ROCK WOOL MANUFACTURING CO — Delta Board

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

5A. **Fiber, Sprayed*** — (Not Shown — Not for use with Item 6) — As an alternate to Batts and Blankets (Item 5) — 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/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 6B is used, Fiber, Sprayed shall be SANCTUARY.

Applegate Greenfiber Acquisition LLC — Insulmax and SANCTUARY for use with wet or dry application.

5B. **Fiber, Sprayed*** — (Not Shown - Not for use with Item 6) — As an alternate to Batts and Blankets (Item 5) - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

NU-WOOL CO INC — Cellulose Insulation

5C. **Batts and Blankets*** — Required for use with resilient channels, Item 7, 3 in. thick mineral wool batts, friction-fitted to fill interior of wall.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

5D. **Glass Fiber Insulation** — (As an alternate to Item 5C) — 3 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, friction-fitted to fill the interior of the wall. See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

5E. **Batts and Blankets*** — (Required for use with Wall and Partition Facings and Accessories, Item 3D) — Glass fiber insulation, nom 3-1/2 in. thick, min. density of 0.80 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less, friction-fitted to completely fill the stud cavities. See Batts and Blankets Category (BKNV) for names of manufacturers.

5F. **Fiber, Sprayed*** — (Optional, Not Shown — Not for use with Items 6, 6A, 6B, 6C, or 6D) — As an alternate to Batts and Blankets (Item 5) and Item 5A - 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

5G. **Fiber, Sprayed*** — (Optional, Not Shown — Not for use with Items 6, 6A, 6B, 6C, or 6D). — As an alternate to Batts and Blankets (Item 5) and Item 5A - Brown Colored Spray applied cellulose fiber. The fiber is applied with water to completely fill the enclosed stud cavity in accordance with the application instructions supplied with the product. The minimum dry density shall be 4.30 lbs/ft³.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

5H. **Foamed Plastic*** — (Optional -For use with Item 3R) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

Holcim Solutions and Products US, LLC — Nexseal™ 2.0 or Nexseal™ 2.0 LE Spray Foam and Sucraseal Spray Foam.

5I. **Fiber, Sprayed*** — (Not Shown — Not for use with Item 6) — As an alternate to Batts and Blankets (Item 5) - 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. To facilitate the installation of the material, any thin, woven or non-woven netting may be attached by any means possible to the outer face the studs. The material shall reach equilibrium moisture content before the installation of materials on either face of the studs. The minimum dry density shall be 5.79 lbs/ft³.

Applegate Greenfiber Acquisition LLC— Applegate Advanced Stabilized Cellulose Insulation

5J. **Foamed Plastic*** — (Optional, Not Shown - For use with Item 3U) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

HOLCIM SOLUTIONS AND PRODUCTS US, LLC — Types GacoEZSpray F4500, GacoProFill FR6500R, Gaco 052N, GacoOnePass F1850, GacoOnePass Low GWP F1880, and Gaco WallFoam 183M

5K. **Foamed Plastic*** — (Optional, Not Shown - For use with Item 3V) — Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

CARLISLE SPRAY FOAM INSULATION — Types SealTite ONE, SealTite Pro Closed Cell (CC), SealTite Pro Open Cell (OC), SealTite Pro OCX, SealTite Pro No Trim 21, SealTite Pro One Zero, Foamsulate Closed Cell, Foamsulate OCX, Foamsulate 70, and Foamsulate HFO.

5L. **Foamed Plastic*** - (Optional, Not Shown – For use with Item 3W) - Spray applied, foamed plastic insulation, at any thickness from partial fill to completely filling stud cavity.

BASF CORP – Types Enertite® NM, Enertite® G, FE178®, Spraytite® 178, Spraytite® 81206, Walltite® 200, Walltite® US, Walltite® US-N, Walltite® HP+, Spraytite® Comfort XL, Walltite® XL, , Walltite® MAX, Walltite® LWP, Walltite® Plus and Enertite® Max

6. **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 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6a) to studs. Clips spaced 48 in. OC. RSIC-1 and RSIC-1 (2.75) clips secured to studs with No. 8 x 2-1/2 in. coarse drywall screw through the center grommet. RSIC-V and RSIC-V (2.75) 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. RSIC-1 and RSIC-V clips for use with 2-9/16 in. wide furring channels. RSIC-1 (2.75) and RSIC-V (2.75) clips for use with 2-23/32 in. wide furring channels.

PAC INTERNATIONAL L L C — Types RSIC-1, RSIC-V, RSIC-1 (2.75), RSIC-V (2.75)

6A. **Steel Framing Members*** — (Optional, Not Shown) — Furring channels and Steel Framing Members on one side of studs 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. Batts and Blankets placed in stud cavity as described in Item 5. Two layers of gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Aa) to one side of studs only. 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

6B. **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. 2-3/8 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 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ba) 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

6C. **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. 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 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Ca) to studs. Clips spaced 48 in. OC., and secured to studs with No. 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 A237 or A237R

6D. **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, 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 a double strand of No. 18 AWG twisted steel wire. Gypsum board attached to furring channels as described in Item 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Da) 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

6E. Steel Framing Members* — (Optional, Not Shown) — 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 3.

b. **Steel Framing Members*** — Used to attach resilient channels (Item 6Ea) 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

6F. 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. 2-23/32 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 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 6Fa) to studs. Clips spaced 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

6G. Steel Framing Members* — (Optional, Not Shown) — Used as an alternate method to attach resilient channels to wall studs. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and spaced max 16 in. O.C. Channel ends butted and centered under the structural members and attached with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the structural members with the screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Type RC-1 Boost

7. Furring Channel — Optional — Not Shown — For use on one side of the wall - Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Items 5C or 5D is required.

8. Caulking and Sealants — (Not Shown, Optional) — A bead of acoustical sealant applied around the partition perimeter for sound control.

9. STC Rating — The STC Rating of the wall assembly is 56 when it is constructed as described by Items 1 through 6, except:

A. Item 2, above — Nailheads Shall be covered with joint compound.

B. Item 2, above — Joints As described, shall be covered with fiber tape and joint compound.

C. Item 5, above — Batts and Blankets* The cavities formed by the studs shall be friction fit with R-19 unfaced fiberglass insulation batts measuring 6-1/4 in. thick and 15-1/4 in. wide.

D. Item 6, above — Steel Framing Members* Type RSIC-1 clips shall be used to attach gypsum board to studs on either side of the wall assembly.

E. Item 8, above — Caulking and Sealants (Not Shown) A bead of acoustical sealant shall be applied around the partition perimeter for sound control.

F. Steel Corner Fasteners (Item 4), Fiber, Sprayed (Items 5A and 5B) and Steel Framing Members (Item 6A), not evaluated as alternatives for obtaining STC rating.

10. Wall and Partition Facings and Accessories* — (Optional, Not Shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 and QR-510

11. Cementitious Backer Units* — (Optional Item Not Shown — For Use On Face Of 1 Hr Systems With All Standard Items Required) - 7/16 in., 1/2 in., 5/8 in., 3/4 in. or 1 in. thick, 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 of 3/8 in. for steel framing members, and a minimum of 3/4 in. for wood framing members spaced a max of 8 in. OC. When 4 ft. wide boards are used, horizontal joints need not be backed by framing.

NATIONAL GYPSUM CO — Type DuraBacker, PermaBase, DuraBacker Plus, or PermaBase Plus

12. Non-Bearing Wall Partition Intersection — (Optional) — Two nominal 2 by 4 in. studs or nominal 2 by 6 in. studs nailed together with two 3 in. 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.

13. Mesh Netting — (Not Shown) — Any thin, woven or non-woven fibrous netting material attached with staples to the outer face of one row of studs to facilitate the installation of the sprayed fiber from the opposite row.

14. Mineral and Fiber Board* — (Optional, Not Shown) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with 2 in. long Type W steel screws, spaced 12 in. OC. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

14A. Mineral and Fiber Board* — (Optional, Not Shown) — For use with Items 14B-14E) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-3/8 in. long ring shanked nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC along board edges and 24 in. OC in field of board along intermediate framing. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

14B. Glass Fiber Insulation — (For use with Item 14A) — 3-1/2 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall. See Batts and Blankets (BKNV or BZJZ) categories for names of Classified companies.

14C. Batts and Blankets* — (As an alternate to Item 14B, For use with Item 14A), 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 3-1/2 in. face of the studs with staples placed 24 in. OC.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

14D. **Adhesive** — (For use with Item 14A) — Construction grade adhesive applied in vertical, serpentine, nominal 3/8 in. wide beads down the length of both vertical edges of Mineral and Fiber Board (Item 14A).

14E. **Gypsum Board*** — (For use with Item 14A) — 5/8 in. thick, 4 ft wide, applied vertically over Mineral and Fiber Board (Item 14A) with vertical joints located anywhere over stud cavities. Secured to mineral and fiber boards with 1-1/2 in. Type G Screws spaced 8 in. OC along edges of each vertical joint and 12 in. OC in intermediate field of the Mineral and Fiber Board (Item 14A). Secured to outermost studs and bearing plates with 2 in. long Type S screws spaced 8 in. OC. Gypsum Board joints covered with paper tape and joint compound. Screw heads covered with joint compound. Finish Rating 30 Min.

AMERICAN GYPSUM CO — Type AG-C

CGC INC — Types C, IP-X2, IPC-AR

CERTAINTED GYPSUM INC — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types FSK-C, FSW-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-C

PANEL REY S A — Type PRC

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

14F. **Mineral and Fiber Board** — (Optional, Not Shown) — For optional use as an additional layer on one side of wall - Nom 1/2 in. thick, 4 ft wide, square edge fiber boards applied vertically to studs on one side of the wall in between the wood studs and the UL Classified Gypsum Board (Item 3). Fiber boards installed with 1-1/4 in. long, Type W, bugle head, coarse thread gypsum board screws spaced 12 in. OC max, with the last screws spaced 2 in. and 6 in. from edge of board. Gypsum board (Item 3) installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

BLUE RIDGE FIBERBOARD INC — SoundStop

14G. **Building Units** – (Optional Item Not Shown – For use over Gypsum Board, Item 3) 1 in., 2 in. or 3 in. thick, 4 ft. wide – Applied vertically or horizontally with vertical joints centered over studs. Fastened to studs and runners with wafer head screws of adequate length to penetrate framing by a minimum of 3/4 in., spaced a max 8 in. o.c.

NATIONAL GYPSUM CO – Type PBCI

*** 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 2024-06-14

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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.
 - Only products which bear UL's Mark are considered Certified.
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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. **U309**

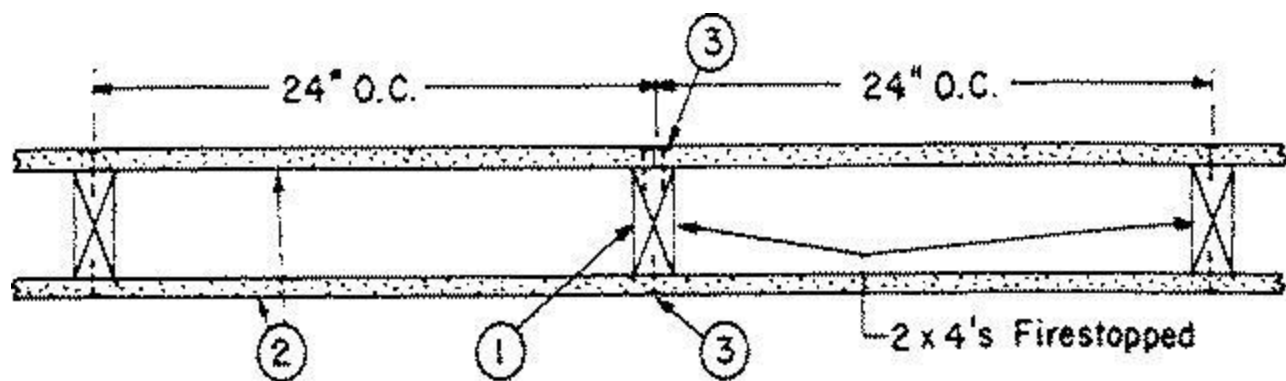
January 30, 2024

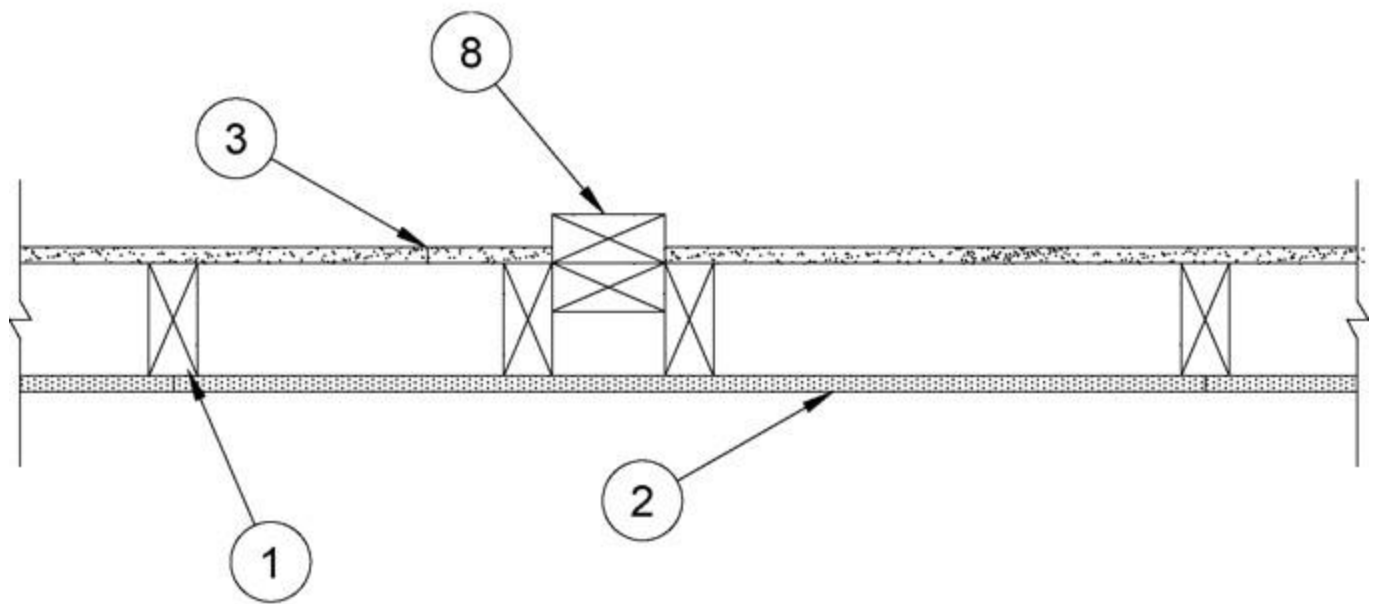
Bearing Wall Rating — 1 Hr.

Finish Rating — See Items 2, 2A and 2B

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 24 in. OC effectively firestopped.

2. **Gypsum Board*** — 5/8 in. thick, 4 ft wide, applied either horizontally or vertically, nailed to studs and bearing plates with 6d cement coated nails min. 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads spaced 7 in. OC. Finish Rating 27 Min. When used in widths other than 48 in., gypsum board to be installed horizontally.

When **Steel Framing Members*** (Items 5 or any alternate clips) are used, wallboard attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When Item 6, resilient channels are used, 5/8 in. thick, 4 ft wide applied vertically. Screw attached furring channels with 1 in. long, self-drilling, self-tapping Type S or S-12 steel screws spaced 8 in. OC, vertical joints located midway between studs.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, LightRoc

BEIJING NEW BUILDING MATERIALS PUBLIC LTD CO — Type DBX-1

CABOT MANUFACTURING ULC — Type X, 5/8 Type X, Type Blueglass Exterior Sheathing

CERTAINTED GYPSUM INC — Type X-1, Types EGRG, GlasRoc, GlasRoc-2, Type C, Type LWTX

CERTAINTED GYPSUM INC — Types LGFC6A, LGFC2A, LGFC-C/A, LGCF-WD, LGLLX, CLLX

GEORGIA-PACIFIC GYPSUM L L C — Types 5, 6, 9, C, DAP, DD, DA, DAPC, DGG, DS, GPFS6, LS (finish rating 23 min), Type X, Veneer Plaster Base - Type X, Water Rated - Type X, Sheathing - Type X, Soffit - Type X, TG-C, Type LWX, Veneer Plaster Base-Type LWX, Water Rated-Type LWX, Sheathing Type-LWX, Soffit-Type LWX, Type DGLW, Water Rated-Type DGLW, Sheathing Type- DGLW, Soffit-Type DGLW, Type LW2X, Veneer Plaster Base - Type LW2X, Water Rated - Type LW2X, Sheathing - Type LW2X, Soffit - Type LW2X, Type DGL2W, Water Rated - Type DGL2W, Sheathing - Type DGL2W

NATIONAL GYPSUM CO — Types -eXP-C, FSK, FSK-C, FSW, FSW-3, FSW-5, FSW-C, FSW-G, FSMR-C, FSW-6 (finish rating 20 min), FSL, FSW-8, RSX

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type C, PG-9, PG-11, PG-C, PGS-WRS, PGI

PANEL REY S A — Types GREX, GRIX, PRC, PRC2, PRX, RHX, MDX, ETX

SIAM GYPSUM INDUSTRY (SARABURI) CO LTD — Type EX-1

THAI GYPSUM PRODUCTS PCL — Type X, Type C

2A. Gypsum Board* — (As an alternate to Item 2, Not Shown) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically to studs and bearing plates on one side of the assembly with 1-5/8 in. long Type S screws spaced 12 in. OC at perimeter of panels and 8 in. OC in the field. Horizontal joints of vertically applied panels need not be backed by studs. Panel joints covered with paper tape and two layers of joint compound. Screwheads covered with two layers of joint compound. Batts and Blankets placed in stud cavity as described in Item 4E. Not evaluated for use with Steel Framing Members, Furring Channels or Fiber, Sprayed.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 530 (finish rating 23 min)

2B. Gypsum Board* — (As an alternate to Item 2) — 5/8 in. thick gypsum panels, with square 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 two screws 1 and 4 in. from edge of board or nailed to studs and bearing plates with 6d cement coated nails 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam heads spaced 7 in. OC. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

GEORGIA-PACIFIC GYPSUM L L C — Type DGG, GreenGlass Type X (finish rating 23 min).

2C. Gypsum Board* — (As an alternate to Item 2) — 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically only and secured as described in Item 2.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board (finish rating 27 min)

NATIONAL GYPSUM CO — Type SBWB

2D. **Gypsum Board*** — (As an alternate to Items 2 through 2C) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock ES

2E. **Gypsum Board*** — (As an alternate to Item 2) — 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically or horizontally and secured with 1-1/4 in. Type W coarse thread gypsum panel steel screws spaced a maximum of 12 in. OC.

CERTAINTED GYPSUM INC — Type SilentFX

2F. **Gypsum Board*** — (As an alternate to 5/8 in. Type FSW in Item 2) — 2 layers nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Horizontal joints on the same side need not be staggered. Inner layer attached with fasteners, as described in item 2, spaced 24 in. OC. Outer layer attached per Item 2.

NATIONAL GYPSUM CO — Type FSW

2G. **Gypsum Board*** — (As an alternate to Item 2) — 5/8 in. thick, 4 ft. wide, applied vertically or horizontally with vertical joints centered over studs and staggered one stud cavity on opposite sides of studs. Secured as described in Item 2 or 2K.

CERTAINTED GYPSUM INC — 5/8" Easi-Lite Type X

THAI GYPSUM PRODUCTS PCL — 5/8" Easi-Lite Type X

2H. **Wall and Partition Facings and Accessories*** — (As an alternate to Item 2) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527.

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 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.

CERTAINTED GYPSUM INC — Type LGFC6A (finish rating 21 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

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 as described in Item 2 or 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. When square edge boards are used joint treatment, Item 3, may be omitted.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C

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

2K. **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 1/2 in. from edge of board. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

CERTAINTED GYPSUM INC — Type X-1, Types EGRG, GlasRoc, GlasRoc-2, Type C

3. **Joints and Fastener Heads** — Wallboard joints covered with paper tape and joint compound. Fastener heads covered with joint compound. Gypsum plaster not more than 1/8 in. thick may be applied over the wallboard in addition to the specified joint treatment.

4. **Batts and Blankets*** — (Not Shown) — Optional glass fiber insulation.

CERTAINTED CORP

JOHNS MANVILLE

OWENS CORNING

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/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product. When Item 5 is used, Fiber, Sprayed shall be SANCTUARY.

Applegate Greenfiber Acquisition LLC — SANCTUARY for use with wet or dry application. Insulmax is to be used for dry application only

4B. Fiber, Sprayed* — As an alternate to Batts and Blankets (Item 4) — Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

NU-WOOL CO INC — Cellulose Insulation

4C. Batts and Blankets* — Required for use with resilient channels, Item 6, 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 4 in. face of the studs with staples placed 24 in. OC.

ROCKWOOL — Type SAFEnSOUND, min. 1.69 pcf.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

4D. Glass Fiber Insulation — (As an alternate to Item 4C) — 3 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall, attached to the 4 in. face of the studs with staples placed 24 in. OC. See **Batts and Blankets** (BKNV or BZJZ) Categories for names of Classified companies.

4E. Batts and Blankets* — (Required for use with Wall and Partition Facings and Accessories, Item 2A) — Glass fiber insulation, nom 3-1/2 in. thick, min. density of 0.80 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less, friction-fitted to completely fill the stud cavities. See Batts and Blankets Category (BKNV) for names of manufacturers.

4F. 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/ft³.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

4G. 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. To facilitate the installation of the material, any thin, woven or non-woven netting may be attached by any means possible to the outer face the studs. The material shall reach equilibrium moisture content before the installation of materials on either face of the studs. The minimum dry density shall be 5.79 lbs/ft³.

Applegate Greenfiber Acquisition LLC — Applegate Advanced Stabilized Cellulose Insulation

5. 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. Wallboard attached to furring channels as described in Item 2.

b. **Steel Framing Members*** — Used to attach furring channels (Item a) to studs (Item 1). 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 3-9/16 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)

5A. Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 5) — 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

5B. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 5) — 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 5Ba) 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

5C. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 5) — 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 5Cb. 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 3.

b. **Steel Framing Members*** — Used to attach furring channels (Item 5Ca) 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

5D. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 5) — 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 3.

b. **Steel Framing Members*** — Used to attach resilient channels (Item 5Da) 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

5E. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 5) — Used as an alternate method to attach resilient channels to wall studs. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels and spaced max 24 in. O.C. Channel ends butted and centered under the structural members and attached with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the structural members with the screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Type RC-1 Boost

5F **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 5) — 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. 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 3.

b **Steel Framing Members*** — Used to attach furring channels (Item 5Fa) 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

6. **Furring Channel** — Optional — Not Shown — For use on one side of the wall - Resilient channels, 25 MSG galv steel, spaced vertically 24 in. OC, flange portion screw attached to one side of studs with 1-1/4 in. long diamond shaped point, double lead Phillips head steel screws. When resilient channels are used, insulation, Items 4C or 4D is required.

7. **Wall and Partition Facings and Accessories*** — (Optional, Not Shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 and QR-510

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.

9. **Mineral and Fiber Board*** — (Optional, Not Shown) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with 2 in. long Type W steel screws, spaced 12 in. OC. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

9A. **Mineral and Fiber Board*** — (Optional, Not Shown) — For use with Items 9B-9E) — For optional use as an additional layer on one side of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-3/8 in. long ring shanked nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC along board edges and 24 in. OC in field of board along intermediate framing. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

9B. **Glass Fiber Insulation** — (For use with Item 9A) — 3-1/2 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall. See Batts and Blankets (BKNV or BZJZ) categories for names of Classified companies.

9C. **Batts and Blankets*** — (As an alternate to Item 9B, For use with Item 9A), 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 3-1/2 in. face of the studs with staples placed 24 in. OC.

ROCKWOOL — Type SAFEnSOUND, min. 1.69 pcf.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

9D. **Adhesive** — (For use with Item 9A) — Construction grade adhesive applied in vertical, serpentine, nominal 3/8 in. wide beads down the length of both vertical edges of Mineral and Fiber Board (Item 9A).

9E. **Gypsum Board*** — (For use with Item 9A) — 5/8 in. thick, 4 ft wide, applied vertically over Mineral and Fiber Board (Item 9A) with vertical joints located anywhere over stud cavities. Secured to mineral and fiber boards with 1-1/2 in. Type G Screws spaced 8 in. OC along edges of each vertical joint and 12 in. OC in intermediate field of the Mineral and Fiber Board (Item 9A). Secured to outermost studs and bearing plates with 2 in. long Type S screws spaced 8 in. OC. Gypsum Board joints covered with paper tape and joint compound. Screw heads covered with joint compound. Finish Rating 30 Min.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Type FRPC, Type C

CGC INC — Types C, IP-X2, IPC-AR

CERTAINTED GYPSUM INC — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types FSK-C, FSW-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-C.

PANEL REY S A — Types PRC, PRC2

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO — Types C, IP-X2, IPC-AR

USG MEXICO S A DE C V — Types C, IP-X2, IPC-AR

9F. **Mineral and Fiber Board** — (Optional, Not Shown) — For optional use as an additional layer on one side of wall - Nom 1/2 in. thick, 4 ft wide, square edge fiber boards applied vertically to studs on one side of the wall in between the wood studs and the UL Classified Gypsum Board (Item 2). Fiber boards installed with 1-1/4 in. long, Type W, bugle head, coarse thread gypsum board screws spaced 12 in. OC max, with the last screws spaced 2 in. and 6 in. from edge of board. Gypsum board (Item 2) installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

BLUE RIDGE FIBERBOARD INC — SoundStop

10. **Wall and Partition Facings and Accessories*** — (CLBV) (Optional, Not Shown) — For use with Item 1, Item 2, Item 3, Items 4, and Item 6. For maximum fire rating of 1 hour. On one side of the wall, over the first layer of Gypsum Board (Item 2), install RefleXor membrane with the gold side facing outwards. Membrane installed with T50 staples spaced 12 inches on center in both directions as per manufacturer's instructions, seams in membrane to be overlapped by 2 inches. When RefleXor membrane is used an additional layer of Gypsum Board that is identical to the first layer and as specified in Item 2 shall be installed over the membrane. Additional layer of Gypsum Board to be installed through the membrane to the stud as specified in Item 2 except the fastener length shall be increased by a minimum of 5/8 inch. Install Batts and Blankets in the stud cavity as per Item 4.

On the other side of the wall prior to the installation of the Gypsum Board install Resilient Channels as per Item 6. Over the Resilient Channel install 3/4 inch thick SONOpan panel secured to the Resilient Channel with min. 1-1/4 in. long drywall screws and washers spaced at 16 in. OC on the perimeter of the panel and 8 in. OC in the field of the panel. Over the SONOpan panel install the same Gypsum Board as specified in Item 2 with the fastener length increased by minimum 3/4 inch. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

Alternately, on the other side of the wall prior to the installation of the Gypsum Board (Item 2), install 3/4 in. thick SONOpan panels, secured to one side of studs either horizontally or vertically. Panels secured to each stud with min. 1-1/4 in. long drywall screws spaced 12 in. OC. Over the SONOpan, install 25 MSG galv. steel, Resilient Channels, spaced vertically 24 in. OC. Resilient Channels fastened through panels to each stud with min. 2 in. long drywall screws or self-tapping screws. Over the Resilient Channels install Gypsum Board as specified in Item 2 with drywall screws as specified in Item 2. Panels not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

MSL — RefleXor membrane, SONOpan panel

*** 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 2024-01-30

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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.
 - Only products which bear UL's Mark are considered Certified.
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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. **U341**

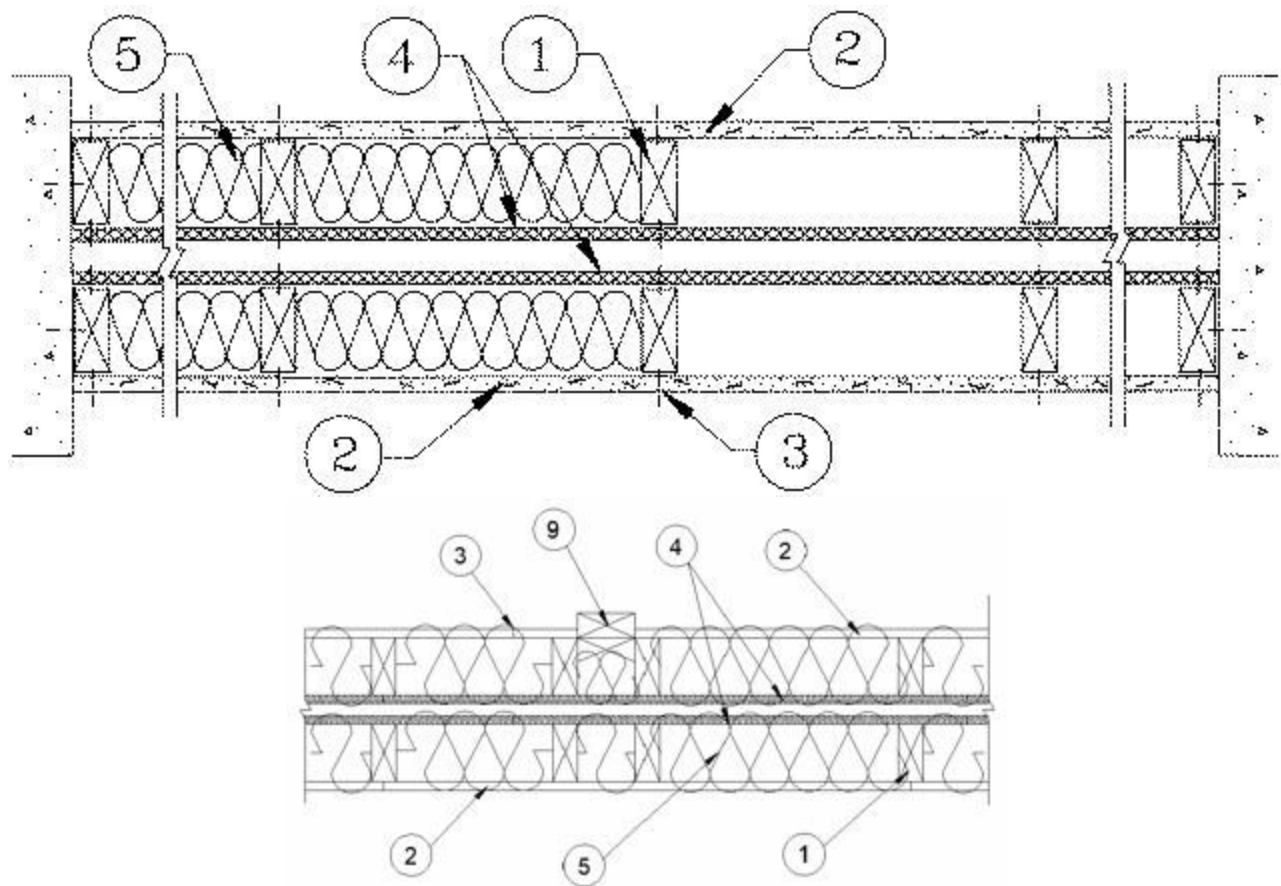
January 31, 2024

Bearing Wall Rating — 1 Hr.

Finish Rating — Min 20 min.

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.**



HORIZONTAL SECTION

1. **Wood Studs** — Nom 2 by 4 in., spaced 24 in. OC max. Cross braced at mid-height and effectively firestopped at top and bottom of wall. No min. air space between stud rows except to accommodate attachment of sheathing, where required. See items 4 and 5.

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. Gypsum board applied horizontally or vertically, unless specified below, and nailed to studs and bearing plates 7 in. OC with 6d cement coated nails, 1-7/8 in. long, 0.0915 in. shank diam and 1/4 in. diam head. As an alternate, No. 6 bugle head drywall screws, 1-7/8 in. long, may be substituted for the 6d cement coated nails.

When **Steel Framing Members*** (Item 6 or any alternate clips) are used, wallboard attached to furring channels with 1 in. long Type S bugle-head steel screws spaced 12 in. OC.

When used in widths other than 48 in., gypsum board to be installed horizontally.

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

CERTAINTED GYPSUM INC ([View Classification](#)) — CKNX.R3660

CGC INC ([View Classification](#)) — CKNX.R19751

CERTAINTED GYPSUM INC ([View Classification](#)) — CKNX.R18482

GEORGIA-PACIFIC GYPSUM L L C ([View Classification](#)) — CKNX.R2717

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 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) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically to studs and bearing plates on one side of the assembly with 1-5/8 in. long Type S screws spaced 12 in. OC at perimeter of panels and 8 in. OC in the field. Horizontal joints of vertically applied panels need not be backed by studs. Panel joints covered with paper tape and two layers of joint compound. Screwheads covered with two layers of joint compound. Batts and Blankets placed in stud cavity as described in Item 5C. Not evaluated for use with Steel Framing Members, Furring Channels or Fiber, Sprayed.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-530 (finish rating 23 min).

2B. **Gypsum Board*** — (As an alternate to Item 2, not shown) — Any 5/8 in. thick 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 horizontally or 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. When used in widths other than 48 in., gypsum board to be installed horizontally.

UNITED STATES GYPSUM CO

USG BORAL DRYWALL SFZ LLC

USG MEXICO S A DE C V

2C. **Gypsum Board*** — (As an alternate to Item 2, Not Shown) — 5/8 in. thick gypsum panels applied horizontally or 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. When used in widths other than 48 in., gypsum board to be installed horizontally.

AMERICAN GYPSUM CO — Types AGX-1, M-Glass, AG-C, LightRoc

CERTAINTED GYPSUM INC — Type C or Type X-1

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

THAI GYPSUM PRODUCTS PCL — Type C or Type X

2D. **Gypsum Board*** — (As an alternate to Items 2, 2A, 2B and 2C) — 5/8 in. thick gypsum panels, with square 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 2 screws 1 and 4 in. from edge of board or nailed as described in Item 2. When used in widths of other than 48 in., gypsum boards are to be installed horizontally.

GEORGIA-PACIFIC GYPSUM L L C — GreenGlass Type X, Type DGG.

2E. **Gypsum Board*** — (As an alternate to Items 2 through 2D) — 5/8 in. thick, 4 ft. wide, paper surfaced applied vertically only and secured as described in Item 2.

GEORGIA-PACIFIC GYPSUM L L C — Type X ComfortGuard Sound Deadening Gypsum Board.

2F. **Gypsum Board*** — (As an alternate to Items 2 through 2E) - Installed as described in Item 2. 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. Not for use with item #6.

NATIONAL GYPSUM CO — Type SBWB

2G. **Gypsum Board*** — (As an alternate to Items 2 through 2F) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Types QuietRock ES.

2H. **Gypsum Board*** — (As an alternate to Items 2 through 2G) — Installed as described in Item 2. 5/8 in. thick, 4 ft. wide, paper surfaced, applied vertically or horizontally fastened to the studs and plates with 1-1/4 in. long Type W coarse thread gypsum panel steel screws spaced a max 12 in. OC.

CERTAINTED GYPSUM INC — Type SilentFX

2I. **Wall and Partition Facings and Accessories*** — (As an alternate to Items 2 through 2H) — Nominal 5/8 in. thick, 4 ft wide panels, applied vertically and secured as described in Item 2.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock 527.

2J. **Gypsum Board*** — (As an alternate to 5/8 in. Type FSW in Item 2) — 2 layers nom. 5/16 in. thick gypsum panels applied vertically or horizontally. Horizontal joints on the same side need not be staggered. Inner layer attached with fasteners, as described in item 2, spaced 24 in. OC. Outer layer attached per Item 2.

NATIONAL GYPSUM CO — Type FSW.

2K. **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.

CERTAINTED GYPSUM INC — Type LGFC6A (finish rating 21 min), Type LGFC2A, Type LGFC-C/A, Type LGFC-WD, Type LGLLX

3. **Joints and Nailheads** — Gypsum board joints of outer layer covered with tape and joint compound. Nail heads of outer layer covered with joint compound. As an alternate, nom 3/32 in. thick gypsum veneer plaster may be applied to the entire surface of Classified veneer baseboard with joints reinforced with paper tape.

4. **Sheathing** — (Optional) — Septum may be sheathed with min 7/16 in. thick wood structural panels min grade "C-D" or "Sheathing" or min 1/2 in. thick **Mineral and Fiber Boards***.

See **Mineral and Fiber Boards** (CERZ) category for names of Classified companies.

5. **Batts and Blankets*** — 3-1/2 in. max thickness glass or mineral fiber batt insulation. **Optional** when sheathing (Item 4) is used on both halves of wall.

See **Batts and Blankets** (BZJZ) category for list of Classified companies.

5A. **Fiber, Sprayed*** — As an alternate to Batts and Blankets (Item 5) — 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/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product.

Applegate Greenfiber Acquisition LLC — Insulmax and SANCTUARY for use with wet or dry application.

5B. **Fiber, Sprayed*** — As an alternate to Batts and Blankets (Item 5) when Sheathing (Item 4) is used on both halves of wall - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft.

5C. Batts and Blankets* — (Required for use with Wall and Partition Facings and Accessories, Item 2A. Use of Sheathing, Item 4, does not nullify requirement of Item 5C for use with Item 2A) — Glass fiber insulation, nom 3-1/2 in. thick, min. density of 0.80 pcf, with a flame spread of 25 or less and a smoke developed of 50 or less, friction-fitted to completely fill the stud cavities. See Batts and Blankets Category (BKNV) for names of manufacturers.

5D. Fiber, Sprayed* — As an alternate to Batts and Blankets (Item 5) and Item 5A when Sheathing (Item 4) is used on both halves of wall - 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/ft³.

INTERNATIONAL CELLULOSE CORP — Celbar-RL

5E. Fiber, Sprayed* — As an alternate to Batts and Blankets (Item 5) - 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. To facilitate the installation of the material, any thin, woven or non-woven netting may be attached by any means possible to the outer face the studs. The material shall reach equilibrium moisture content before the installation of materials on either face of the studs. The minimum dry density shall be 5.79 lbs/ft³.

Applegate Greenfiber Acquisition LLC— Applegate Advanced Stabilized Cellulose Insulation

6. 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. Wallboard attached to furring channels as described in Item 2.

B. Steel Framing Members* — Used to attach furring channels (Item a) to studs (Item 1) . 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).

6A. Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 6) — 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

6B. Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 6) — 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 6Ba) 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

6C. Steel Framing Members* — (Optional, Not Shown, As an alternate to Item 6) — 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 6Cb. 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 6CA) 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

6D. **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — 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 6Da) 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

6E. **Steel Framing Members*** — (Optional, Not Shown) — 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. Gypsum board attached to resilient channels as described in Item 2.

b. **Steel Framing Members*** - Used to attach resilient channels to wall studs. A resilient sound isolation accessory shall be used at each attachment point of the resilient channels to the studs. Channel ends butted and centered under the structural members and attached with one accessory at each end. Additional accessories used to hold resilient channels that support the gypsum board end joints. The accessory envelops the mounting edge of the resilient channel. The accessory and resilient channel are fastened to the studs with the screws supplied with the accessory and per the accessory manufacturer's installation instructions.

PAC INTERNATIONAL L L C — Type RC-1 Boost

6F **Steel Framing Members*** — (Optional, Not Shown, As an alternate to Item 6) — 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. 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 6Fa) 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

7. **Wall and Partition Facings and Accessories*** — (Optional, Not shown) — Nominal 1/2 in. thick, 4 ft wide panels, for optional use as an additional layer on one or both sides of the assembly. Panels attached in accordance with manufacturer's recommendations. When the QR-500 or QR-510 panel is installed between the wood framing and the UL Classified gypsum board, the required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type QuietRock QR-500 and QR-510

8. **Mineral and Fiber Board*** — ((Optional, Not Shown) — For optional use as an additional layer on one or both sides of wall. Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing as described in Item 2. The required UL Classified gypsum board layer(s) is/are to be installed as indicated as to fastener type and spacing, except that the required fastener length shall be increased by a minimum of 1/2 in. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

9. **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.

(Optional, Not Shown) Alternate Construction For Use On One Side Of The Wall.

10. **Mineral and Fiber Board*** — For use with Items 10A-10D) —Nom 1/2 in. thick, 4 ft wide with long dimension parallel and centered over studs. Attached to framing with minimum 1-3/8 in. long ring shanked nails or 1-1/4 in. long Type W steel screws, spaced 12 in. OC along board edges and 24 in. OC in field of board along intermediate framing. Not evaluated or intended as a substitute for the required layer(s) of UL Classified Gypsum Board.

HOMASOTE CO — Homasote Type 440-32

10A. **Glass Fiber Insulation** — (For use with Item 10) — 3-1/2 in. thick glass fiber batts bearing the UL Classification Marking as to Surface Burning and/or Fire Resistance, placed to fill the interior of the wall. See Batts and Blankets (BKNV or BZJZ) categories for names of Classified companies.

10B. **Batts and Blankets*** — (As an alternate to Item 10B, For use with Item 10), 3 in. thick mineral wool batts, placed to fill interior of wall, attached to the 3-1/2 in. face of the studs with staples placed 24 in. OC.

THERMAFIBER/OWENS CORNING — Type SAFB, SAFB FF

10C. **Adhesive** — (For use with Item 10) — Construction grade adhesive applied in vertical, serpentine, nominal 3/8 in. wide beads down the length of both vertical edges of Mineral and Fiber Board (Item 14A).

10D. **Gypsum Board*** — (For use with Item 10) — 5/8 in. thick, 4 ft wide, applied vertically over Mineral and Fiber Board (Item 14A) with vertical joints located anywhere over stud cavities. Secured to mineral and fiber boards with 1-1/2 in. Type G Screws spaced 8 in. OC along edges of each vertical joint and 12 in. OC in intermediate field of the Mineral and Fiber Board (Item 10). Secured to outermost studs and bearing plates with 2 in. long Type S screws spaced 8 in. OC. Gypsum Board joints covered with paper tape and joint compound. Screw heads covered with joint compound. Finish Rating 30 Min.

AMERICAN GYPSUM CO — Type AG-C

CERTAINTED GYPSUM INC — Type C

CERTAINTED GYPSUM INC — Type LGFC-C/A

GEORGIA-PACIFIC GYPSUM L L C — Types 5, DAPC, TG-C

NATIONAL GYPSUM CO — Types FSK-C, FSW-C

PABCO BUILDING PRODUCTS L L C, DBA PABCO GYPSUM — Type PG-C

PANEL REY S A — Type PRC

THAI GYPSUM PRODUCTS PCL — Type C

UNITED STATES GYPSUM CO —Types C, IP-X2, IPC-AR

USG BORAL DRYWALL SFZ LLC — Type C

*** 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 2024-01-31

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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.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

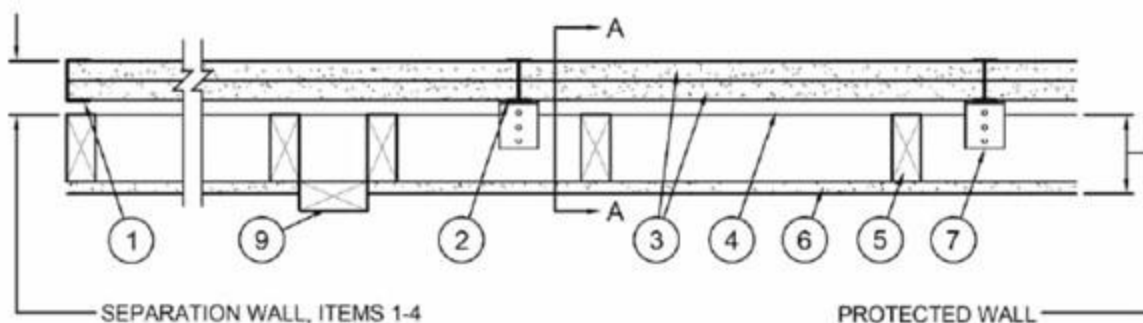
BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

[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**

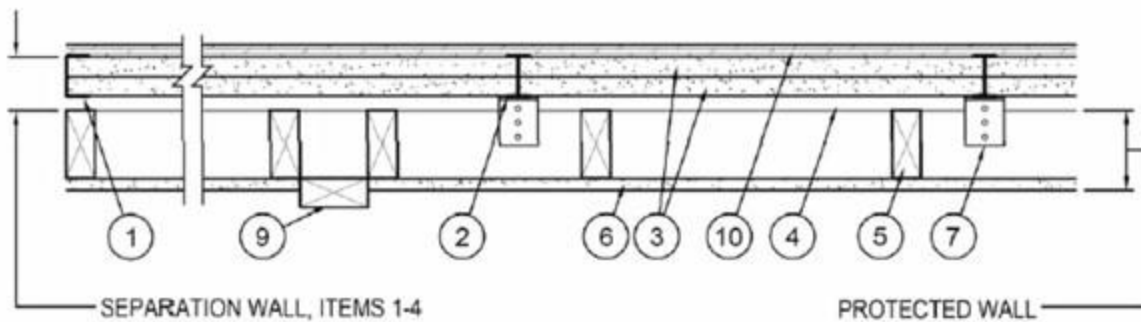
January 29, 2024

Nonbearing Wall Rating — 2 Hr (See Items 5, 5A and 5B) (Separation Wall, See Items 1,2 and 3)**Bearing Wall Rating 2 Hr. (Protected Wall, See Items 5 and 5A)****Nonbearing Wall Rating 2-Hr (Protected Wall, See Item 5, 5A and 5B)****Finish Rating — 120 Min (See Item 5)****STC Ratings — 61, 69, 70 (See Items 8, 8A and 8B)**

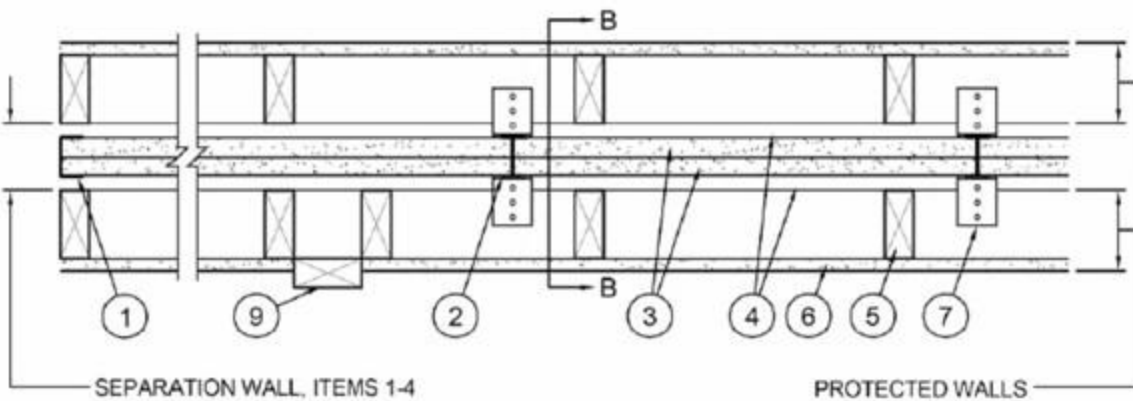
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



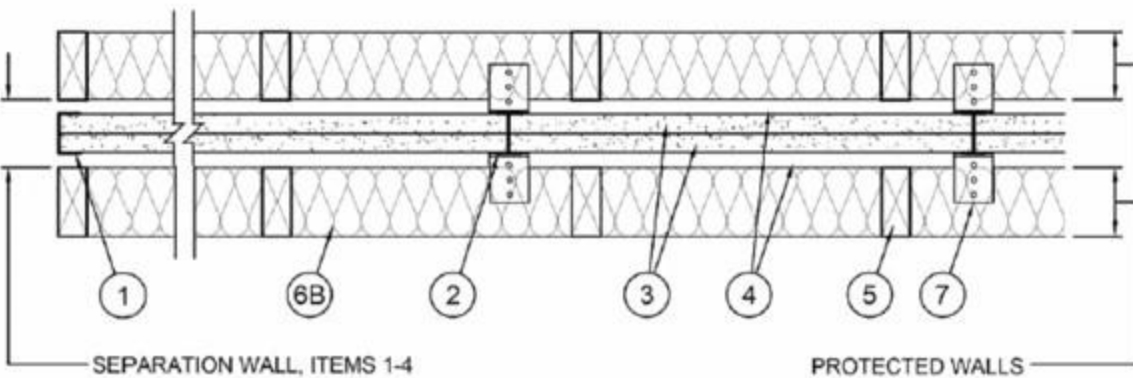
CONFIGURATION A
EXPOSED TO FIRE FROM AREA SEPARATION WALL SIDE ONLY



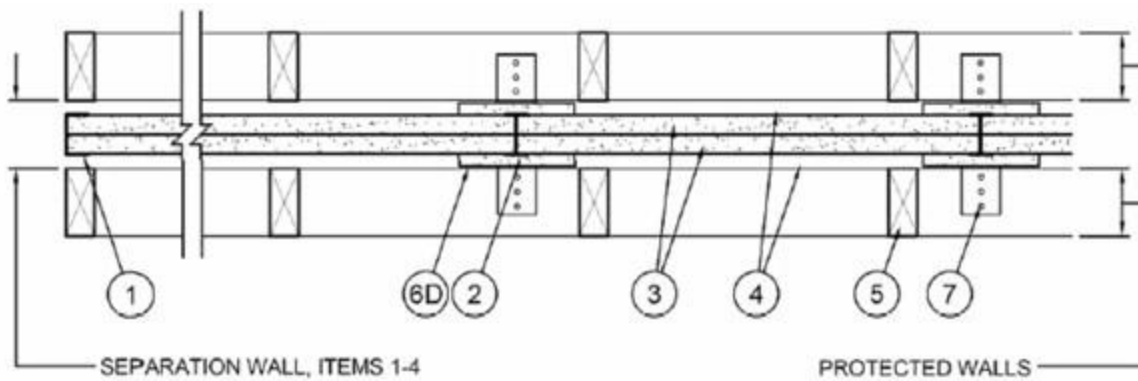
CONFIGURATION B
EXPOSED TO FIRE FROM AREA SEPARATION WALL SIDE ONLY



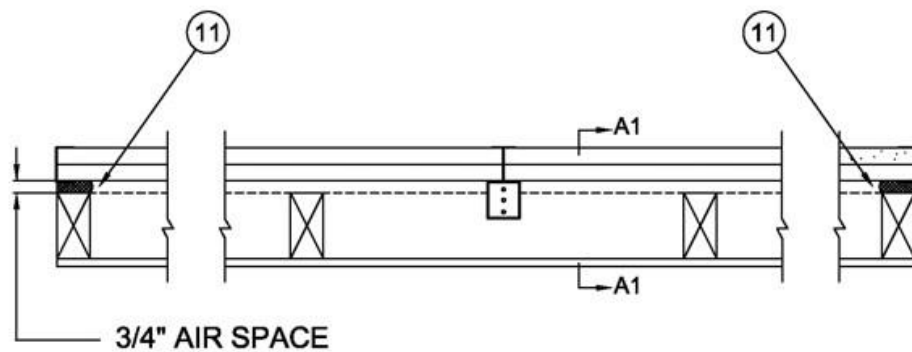
CONFIGURATION C
EXPOSED TO FIRE FROM EITHER SIDE



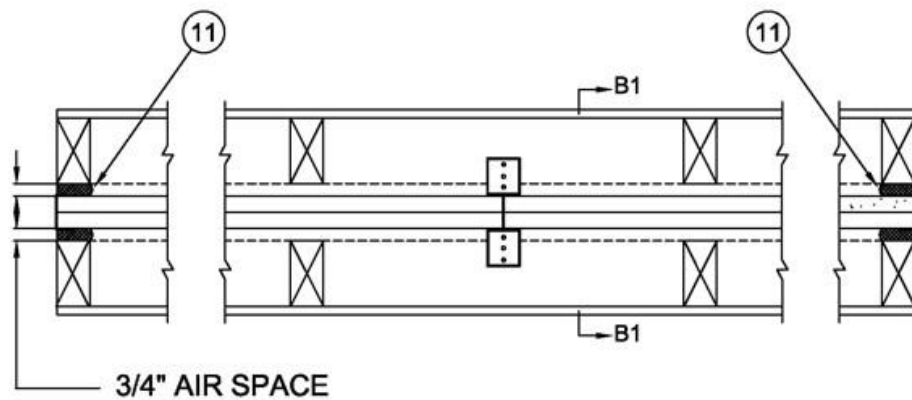
CONFIGURATION D
EXPOSED TO FIRE FROM EITHER SIDE



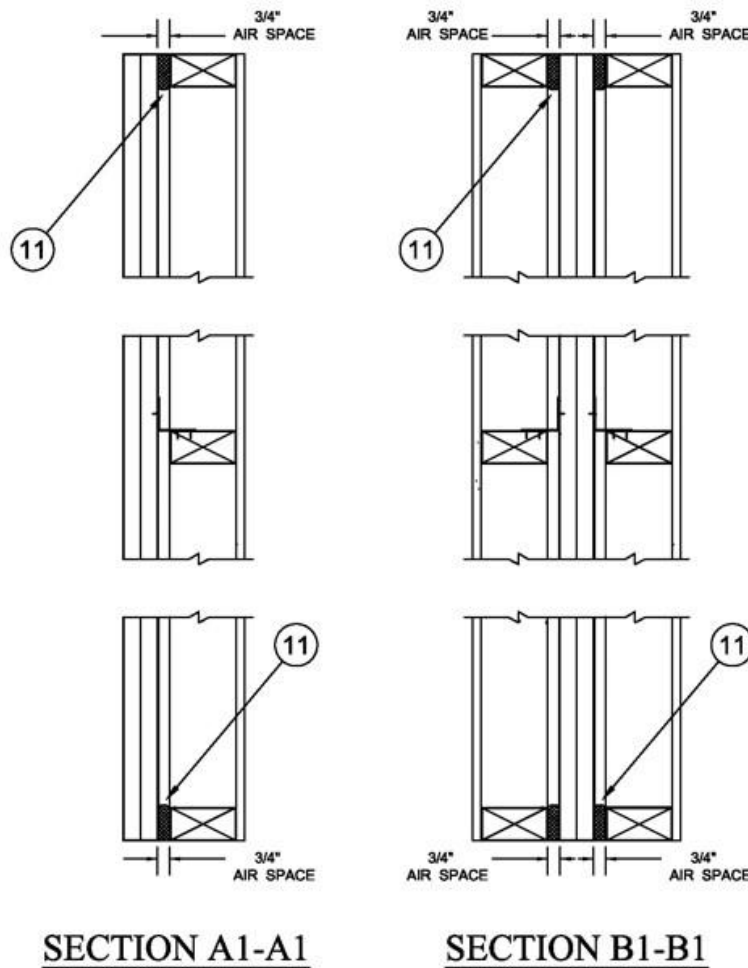
CONFIGURATION E
EXPOSED TO FIRE FROM EITHER SIDE



CONFIGURATIONS A and C
EXPOSED TO FIRE FROM AREA SEPARATION WALL ONLY



CONFIGURATIONS B and D
EXPOSED TO FIRE FROM EITHER SIDE



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 5, 5A, and 5B. When Bearing, Load Restricted for Canadian Applications — See Guide [BXUV7](#).)

4. **Air Space** — Minimum 3/4-in. air space.

5. **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.

5A. **Steel Studs** — (As an alternate to Item 5, 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.

5B. Steel Studs — (As an alternate to Items 5 and 5A, 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.

6. Gypsum Board — Classified or Unclassified — Min 1/2 in. thick, 4 ft wide, applied horizontally or vertically. Wallboard attached to wood studs (Item 5) with 1-1/4 in. long steel drywall screws spaced 12 in. OC. Wallboard attached to steel studs (Item 5A or 5B) 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.

6A. Plywood Sheathing or OSB — (not shown) — As an alternate to Item 6, 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 7.

6B. Batts and Blankets* — (Not shown) — As an alternate to Items 6 and 6A, 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 6 and 6A, the max height is 54 ft and the aluminum clips (Item 7) shall be spaced a max of 5 ft OC vertically. Min 3/4 in. separation between insulation and area separation wall. 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.

6C. Wall and Partition Facings and Accessories* — (not shown) — As an alternate to Items 6, 6A and 6B, 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

6D. Gypsum Board* — As an alternate to Item 6 - 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 7, 7A, 7B, or 7C.

NATIONAL GYPSUM CO — Type FSW-3, FSW, FSW-6.

6E. Fiber, Sprayed* — Optional - Not Shown. - Spray applied cellulose material. The fiber is applied with water to completely or partially fill the enclosed stud cavity and air space in accordance with the application instructions supplied with the product with a nominal dry density of 2.7 lb/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product.

Applegate Greenfiber Acquisition LLC — Insulmax, SANCTUARY, and FRM for use with wet or dry application.

6F. **Building Wrap** – Optional – Not Shown – For use with Items 6-6E - Building wrap fastened to gypsum board, wall sheathing, or studs per manufacturers installation instructions.

7. **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.

7A. 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.

7B. 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.

7C. 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.

8. **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 5, above — Wood Studs — Shall be spaced 16 in. OC.

B. Item 6, 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 7, 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 5A, 5B), Plywood Sheathing or OSB (Item 5A and Item 9) and Batts and Blankets (Items 6B) not evaluated as alternatives for obtaining STC rating.

8A. **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 5, above — Wood Studs — Shall be spaced 16 in. OC.

B. Item 6C, above — Wall and Partition Facings and Accessories* — Type QuietRock QR-510 panels shall be installed.

C. Item 7, 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 5A, 5B), Plywood Sheathing or OSB (Item 6A and Item 10) and Batts and Blankets (Items 6B) not evaluated as alternatives for obtaining STC rating.

8B. **STC Rating** — The STC Rating of the wall assembly is 70 when it is constructed as described by Items 1 through 7, except:

A. Item 5, above - Wood Studs - Shall be spaced 16 in. OC.

B. Item 6C, above - Wall and Partition Facings and Accessories* - Type QuietRock QR-525 panels shall be installed as described in Item 5C.

C. Item 7, 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 5A, 5B), Plywood Sheathing or OSB (Item 6A and Item 10) and Batts and Blankets (Items 6B) not evaluated as alternatives for obtaining STC rating.

9. **Non-Bearing Wall Partition Intersection** — (Optional) Wall system consisting of nominal 2 by 4 in. stud or nominal 2 by 6 in. stud. Maximum one non-bearing wall partition intersection per stud cavity.

10. **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 B. Vertical joints located over studs. Fastened to "H" studs with screws of sufficient length, spaced a maximum of 12 in. OC.

11. **Caulking and Sealants*** — (Optional - Intended for use as an air barrier - Not evaluated as fireblocking) - A bead of sealant applied around the partition perimeter in the 3/4 in. air space between wood framing (Item 5) and shaftliner panels (Item 3) to create an air barrier.

DUPONT DE NEMOURS, INC. — Great Stuff Gaps & Cracks, Great Stuff Pro Gaps & Cracks, Great Stuff Pro Window & Door

ICP CONSTRUCTION INC — Fireblock, Window & Door, Insulating Foam Sealant, Multi-Purpose, HC Sealants, Black Foam Sealant, Extreme, Window & Door Extreme, Fast Foam, Gun Foam, and Straw Foam

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Last Updated on 2024-01-29

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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**

January 29, 2024

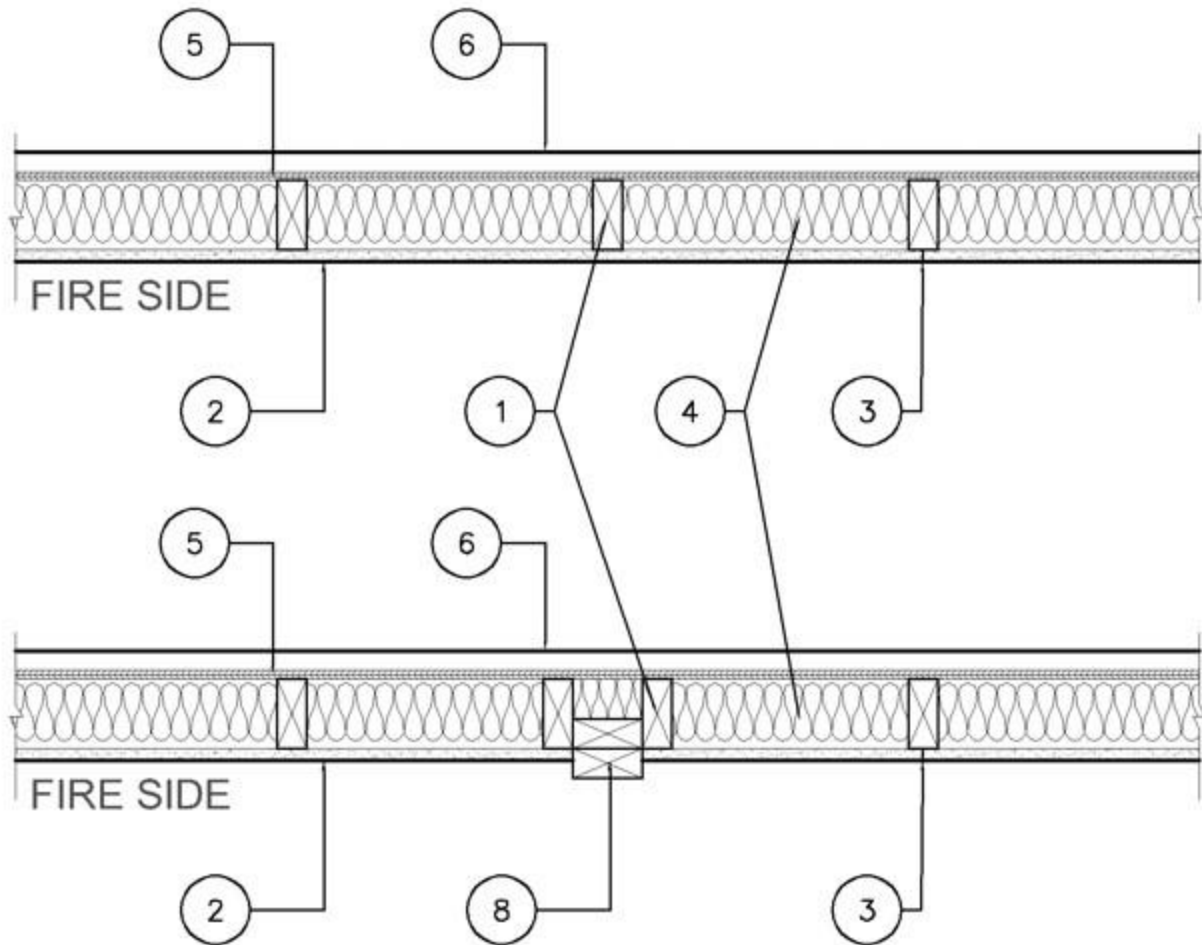
Bearing Wall Rating - 1 Hr Rating Exposed to Fire on Interior Face Only

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

CERTAINTED GYPSUM INC ([View Classification](#)) — CKNX.R3660

CGC INC ([View Classification](#)) — CKNX.R19751

CERTAINTED GYPSUM INC ([View Classification](#)) — CKNX.R18482

GEORGIA-PACIFIC GYPSUM L L C ([View Classification](#)) — CKNX.R2717

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

CERTAINTED GYPSUM INC — Type C, 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.

CERTAINTED 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.

CERTAINTED 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.
CERTAINTED GYPSUM INC — Type C, 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/ft³. Alternate Application Method: The fiber is applied without water or adhesive at a nominal dry density of 3.5 lb/ft³, in accordance with the application instructions supplied with the product.

Applegate Greenfiber Acquisition LLC — Insulmax and SANCTUARY 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/ft³.

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/ft³.

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

K. **Building Units** – 1 in., 2 in. or 3 in. thick, 4 ft. wide composite exterior cement backer board with rigid insulation, finished with ceramic tile, marble, natural stone, manufactured stone, thin brick, Portland cement or synthetic stucco.

NATIONAL GYPSUM CO – Type PBCI

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 KS series with Kingspan PIR core, 3in. nominal thickness; or Designwall 2000 or Designwall 4000D, 2 or 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. 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.

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Last Updated on 2024-01-29

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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. U905

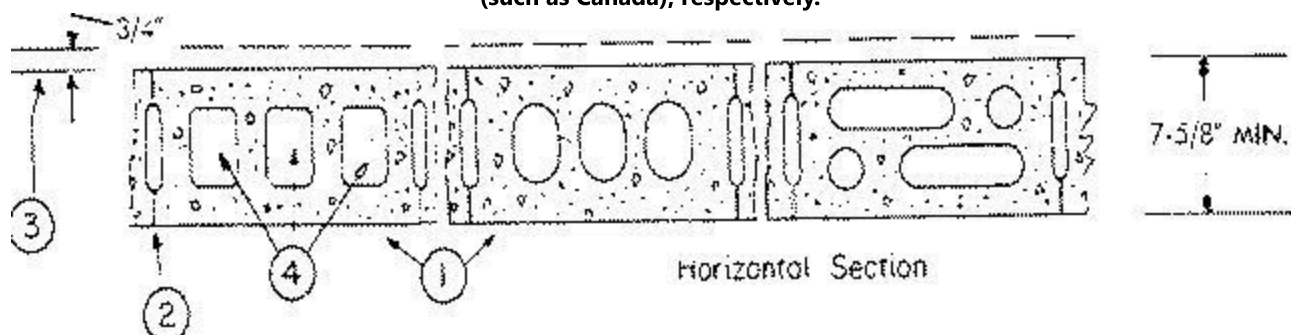
April 14, 2023

Bearing Wall Rating — 2 HR.

Nonbearing Wall Rating — 2 HR

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

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1. **Concrete Blocks*** — Various designs. Classification D-2 (2 hr).

See **Concrete Blocks** category for list of eligible manufacturers.

2. **Mortar** — Blocks laid in full bed of mortar, nom. 3/8 in. thick, of not less than 2-1/4 and not more than 3-1/2 parts of clean sharp sand to 1 part Portland cement (proportioned by volume) and not more than 50 percent hydrated lime (by cement volume). Vertical joints staggered.

3. **Portland Cement Stucco or Gypsum Plaster** — Add 1/2 hr to classification if used. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a max. Classification of 1-1/2 hr. Attached to concrete blocks (Item 1).

4. **Loose Masonry Fill** — If all core spaces are filled with loose dry expanded slag, expanded clay or shale (Rotary Kiln Process), water repellant vermiculite masonry fill insulation, or silicone treated perlite loose fill insulation add 2 hr to classification.

5. **Foamed Plastic*** — (Optional-Not Shown) — 1-1/2 in. thick max, 4 ft wide sheathing attached to concrete blocks (Item 1).

ATLAS ROOFING CORP — EnergyShield Pro Wall Insulation, EnergyShield Pro 2 Wall Insulation, EnergyShield CGF Pro, EnergyShield Ply Pro, EnergyShield® CGF, EnergyShield® PanelCast, EnergyShield® and "EnergyShield® XR

DUPONT DE NEMOURS, INC. — Types Thermax Sheathing, Thermax Light Duty Insulation, Thermax Heavy Duty Insulation, Thermax Metal Building Board, Thermax White Finish Insulation, Thermax ci Exterior Insulation, Thermax XARMOR ci Exterior Insulation, Thermax IH Insulation, Thermax Plus Liner Panel, Thermax Heavy Duty Plus (HDP), TUFF-R™ ci Insulation, Thermax Butler Stylwall Insulation Board and Thermax Morton Heavy Duty Insulation Board

Holcim Solutions and Products US, LLC — "Enverge™ CI Foil Exterior Wall Insulation" and "Enverge™ CI Glass Exterior Wall Insulation"

HUNTER PANELS, A DIVISION OF CARLISLE CONSTRUCTION MATERIALS, LLC — Types "Xci-Class A", "Xci Foil (Class A)", "Xci 286"

RMAX, A BUSINESS UNIT OF SIKA CORPORATION — Types "TSX-8500", "ECOMAXci FR", "TSX-8510", "ECOMAX xi FR White", "ECOMAXci", "ECOMAXci FR Air Barrier", "Thermasheath-XP", "Thermasheath", "Durasheath"

JOHNS MANVILLE — Type "AP Foil-Faced Foam Sheathing"

5A. **Building Units*** — As an alternate to Items 5, min. 1-in thick polyisocyanurate composite foamed plastic insulation boards, nom. 48 by 48 or 96 in.

ATLAS ROOFING CORP — EnergyShield® Ply

HUNTER PANELS, A DIVISION OF CARLISLE CONSTRUCTION MATERIALS, LLC — "Xci NB", "Xci Ply"

RMAX, A BUSINESS UNIT OF SIKA CORPORATION — "Thermasheath-SI", "ECOBASEci", "ThermaBase-CI", "ECOMAXci FR Ply", "ECOMAXci Ply".

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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 - 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

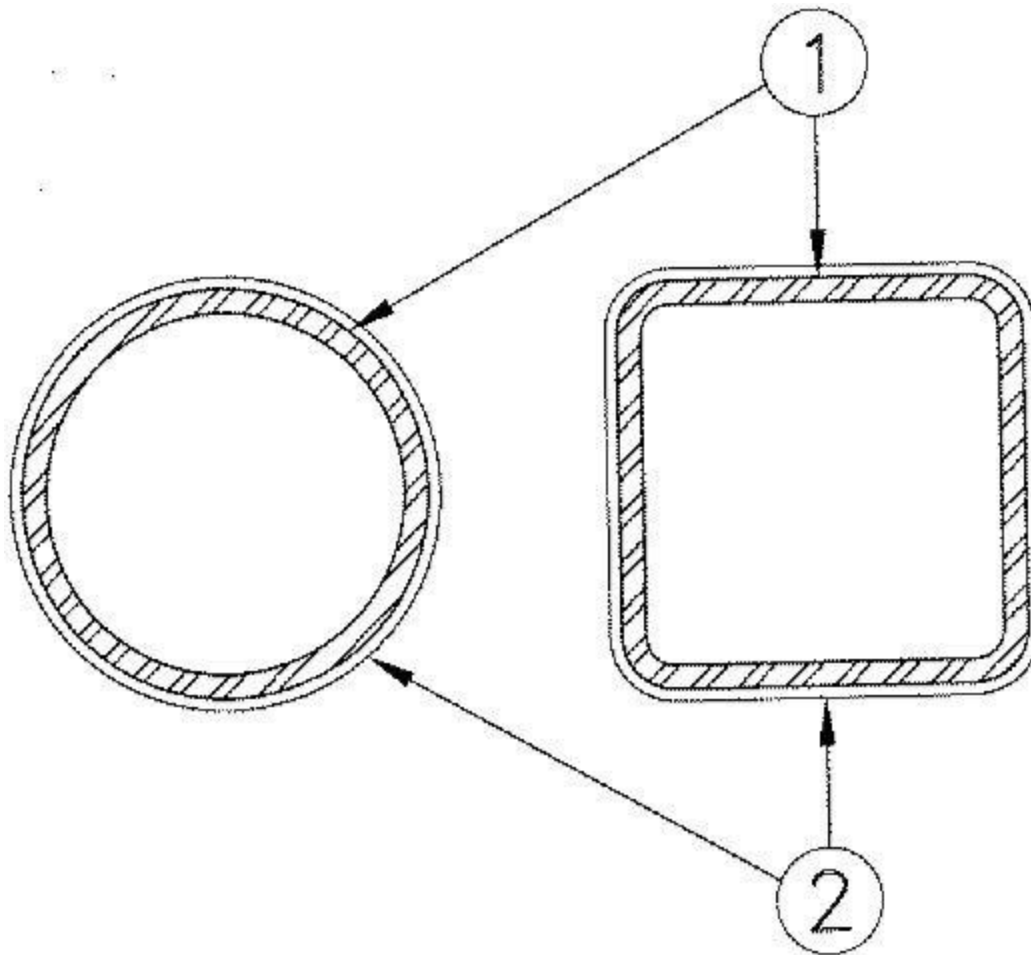
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. Y616

November 17, 2023

Ratings - 1, 1-1/2, 2 and 3 Hr. (See Item 2)

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1. **Steel Column** — Steel tube (ST) or steel pipe (SP) with the minimum sizes shown in the table below. Columns shall be free of dirt, loose scale and oil. Columns shall be primed with a metal alkyd or epoxy primer at a nominal thickness of 1 mil.

2. **Intumescent Fire-resistive Materials*** — Coating spray or brush applied directly from containers to desired thickness. See table below for appropriate minimum final dry thickness and applicable rating.

FOR STEEL PIPE

Steel Size	A/P	HP/A	1 Hr		1-1/2 Hr		2 Hr		3 Hr	
			in.	mm	in.	mm	in.	mm	in.	mm
SP 3 x 0.25	0.23	169	0.102	2.58	0.221	5.62	0.340	8.65	N/A	N/A
SP 5 x 0.3125	0.29	135	0.081	2.05	0.175	4.46	0.270	6.86	N/A	N/A
SP 5 x 0.375	0.35	114	0.067	1.70	0.145	3.69	0.224	5.69	N/A	N/A
SP 6 x 0.432	0.40	102	0.058	1.48	0.127	3.23	0.196	4.97	N/A	N/A
SP 4 x 0.5	0.44	93	0.053	1.35	0.115	2.94	0.178	4.52	N/A	N/A
SP 8 x 0.5	0.47	85	0.047	1.20	0.093	2.35	0.147	3.74	0.288	7.31

N/A = Not Available

FOR SQUARE AND RECTANGULAR STEEL TUBE

Steel Size	A/P	HP/A	1 Hr		1-1/2 Hr		2 Hr		3 Hr	
			in.	mm	in.	mm	in.	mm	in.	mm
ST 5x3x1/4	0.23	169	0.102	2.58	0.221	5.62	0.340	8.65	in.	mm

ST 5x3x5/16	0.29	135	0.081	2.05	0.175	4.46	0.270	6.86	N/A	N/A
ST 8x6x3/8	0.35	114	0.067	1.70	0.145	3.69	0.224	5.69	N/A	N/A
ST 6x6x7/16	0.40	102	0.058	1.48	0.127	3.23	0.196	4.97	N/A	N/A
ST 5x3x1/2	0.44	93	0.053	1.35	0.115	2.94	0.178	4.52	N/A	N/A
ST 8x8x1/2	0.47	85	0.047	1.20	0.093	2.35	0.147	3.74	0.288	7.31

N/A = Not Available

As an alternate to the above table, the required thickness of coating (in inches) to be applied to all surfaces of steel tube (ST) and steel pipe (SP) columns may be determined from the equations listed below. The equations may only be used for the indicated hourly rating, and for the corresponding listed ranges of thickness and A/P.

Hourly Ratng	Thickness Equation, in.	Thickness Range, in.	A/P Ratio Range
1	$T = 0.02336/(A/P)$	0.050 to 0.102	0.23 to 0.47
1-1/2	$T = 0.05081/(A/P)$	0.108 to 0.221	0.23 to 0.47
2	$T = 0.07826/(A/P)$	0.167 to 0.340	0.23 to 0.47

Where T = Thickness of coating in inches, A = Cross-sectional area of the pipe in square inches, and P = Heated perimeter of steel pipe or tube section in inches.

ISOLATEK INTERNATIONAL — Type SprayFilm WB 5, Type WB 5, Investigated for Interior Conditioned Space and Interior General Purpose, Investigated for Exterior Use with top coat as described in Item 3.

NEWKEM PRODUCTS CORP — Type WB 5, Investigated for Interior Conditioned Space and Interior General Purpose, Investigated for Exterior Use with top coat as described in Item 3.

3. **Top Coat** — (Not Shown) — Type TNEMEC 740 required for Exterior Use with Type SprayFilm WB5, applied at a minimum dry thickness of 7 mils over the intumescent material. See Classification information in the Mastic and Intumescent Coating (CDWZ) category, Isolatek International, for mixing requirements.

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